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The Progress of the Bill.

DURING the two days' consideration allotted to the Electricity (Supply) Bill by Standing Committee C of the House of Commons, last week, important changes in the constitution of the new authority were adopted, in principle, which will go far to remove the objectionable features of the original proposals under this head. As we pointed out in our issue of March 26th, a Central Electricity Board which would act as a mere appendage to the Electricity Commission would not serve the purpose for which it was created—namely, to co-ordinate and control the generation of electricity throughout the country. It was necessary, we said, that there should be but one controlling authority—the Central Board—and that the Electricity Commissioners should either become an advisory body to the Board, or be incorporated with it. The latter course, which we favoured, was put forward by the Labour party in Committee, but was rejected on the ground that it was a short-cut to nationalisation of the industry; the alternative, however, was adopted, and the Bill will provide the Board with full executive authority, whilst the Electricity Commissioners will prepare the technical schemes and submit them to the Board for approval. This seems to be a satisfactory solution of a very contentious problem, and the Government has been well advised in adopting it at so early a stage. It is understood that after considering and publishing a scheme put before it by the Electricity Commissioners, the Board will hold an inquiry if necessary; and that an independent tribunal will be set up, not by the Minister of Transport, but perhaps by the Lord Chancellor or some other authority, to hear appeals from the decisions of the Board.

With these proposals the opponents of the Bill have expressed their content. There are, however, many other controversial features in the Bill, and the list of amendments to be considered by the Committee is a long one, comprising some 220 handed in up to April 29th; many of these are of course either consequential or mutually exclusive. Some are designed to prevent injustice to existing power companies; others, to strengthen the obligation laid upon the Central Board

to delegate its functions where possible to joint electricity authorities and other existing authorised undertakers; others, again, to provide the right of appeal against the decisions of the Board or the Electricity Commissioners, the Railway and Canal Commission being usually named as the arbitrator.

An interesting suggestion is made in connection with Clause 14, which enables the Electricity Commissioners to put pressure on an authorised undertaker to take a supply of electricity in bulk owing to its being available from the Board at a lower price than the local power station's working costs—namely, that regard shall be had to any reduction of costs which might reasonably have been anticipated from improvements of the plant then in contemplation; it is often urged that much lower costs could be attained in small stations if the Commissioners would allow them to be extended by the addition of modern plant. A further suggestion in this connection is an entirely new clause, giving power to close any uneconomical station after three years from the date of the Act, but specifying that in comparing the cost of bulk supply and local generation the latter shall not be loaded with the capital charges in respect of the generating station; this is but reasonable, for otherwise the cost to the consumers would be increased by the changeover.

Another proposed new clause is of great importance, and will, we hope, be added to the Bill; it provides that everyone owning a generating station shall furnish to the Electricity Commissioners statistics relating to its operation. As we have pointed out, the Commissioners at present have no certain knowledge, and have no means of obtaining such knowledge, with regard to the capacity and output of private generating stations, so that no trustworthy comparison can be made between the actual consumption of electricity for all purposes in this country, and that recorded in respect of foreign countries. This is a very regrettable circumstance, and it is important that provision shall be made to deal with it, for other reasons besides that above-mentioned.

Again, a clause is put forward which will confer upon local authorities full powers to supply and fix electrical installations, including fittings, motors, &c., on the premises of their consumers, the only remaining restrictions being that they shall not manufacture any of the material, and that they must carry on the work without financial loss.

We regret to observe, however, that the omissions to which we have called attention have not been dealt with by proposed amendments; apart from a derisory clause relating to the lopping of trees, there is not a word about wayleaves and other facilities so urgently necessary—indeed, almost indispensable—to the rapid extension of electricity supply into the rural areas. Seeing that the rural consumption is one of the main factors relied upon by the promoters of the Bill for the cheapening of electrical energy all round, is it not extraordinary that no provision is made to facilitate that development?

Women and Electrical Progress.

One of the most promising movements that is in progress in the electrical world at this moment—at any rate so far as this country is concerned—is the attraction to our ranks of women of a suitable personality and character for helping forward domestic electrical enterprise. If they will excuse the use of such a term, the women who are to afford the right "material" for this branch of development will require to have reached a certain standard of educational fitness and must give evidence of zeal and enthusiasm which will assure a maintained interest in the study of certain aspects of electricity supply work and in the pursuit of knowledge respecting the apparatus which is demonstrated, displayed and sold in showrooms for the use of consumers in the home. Our readers are not unfamiliar with the organised efforts that have been made to bring electrical women together for their mutual advantage and therefore for the good of the industry. There are classes of work in the domestic electrical department which women, and women alone, can do with full effectiveness, as we have shown on several occasions, and the mere men who are running the industry and take a large view of the scope for future electrical development are ready to encourage their co-operation. But nobody will lose sight of the fact that on attractiveness and personality alone they will not succeed in giving that quality of service which so specialised an industry demands. There is no need for personal charms to be sacrified in order to secure business efficiency. The study need not be laborious, indeed it can be made most pleasurable, and the Electric Lamp Manufacturers' Association has discovered how to secure such a result by the arrangement of its first Home Lighting Course for Women, which was held with such success in London last week, and is referred to on a later page of this issue. From our own personal observation we are in a position to congratulate all concerned in this experimental effort upon its complete success, which we believe points the way for other conventions of a similar nature at which women shall be familiarised with the details and operation of other special classes of domestic apparatus, including cooking appliances, electric fires, vacuum cleaners, and so forth. What the Lighting Service Bureau has done through its manager, Mr. W. E. Bush, and the staff will assuredly spread the gospel of more efficient illumination and the advantages that accrue therefrom in the domestic circle, but such educational work is essential in respect of the other appliances mentioned, both for women and for men connected with the showrooms that are springing up in all parts of the country.

The E.T.B.I.

Familiar objects in our daily routine attract little attention, no matter how great their importance; but now and again something occurs to bring them into sharp focus, and we realise their significance, almost with a sense of contrition. Thus it is with the Electrical Trades Benevolent Institution; its annual Festival Dinner brings it into the foreground in the autumn, and its annual general meeting in the spring—the rest is silence, though we know its beneficent work is being efficiently carried on throughout the year by its untiring hon. secretary, Mr. F. B. O. Hawes, and a few members of the Committee.

But we ought not to think of it only two or three times a year; it is one of those things which ought never to be far from the top of the agenda. What can we all do to help? The answer is easy—give it publicity. That can be done most effectively in two ways—by forming a local Committee, and by telling one's friends, employés, and colleagues what it is and what it does.

The splendid work accomplished by the Local Advisory Committees already existing in Cardiff, Manchester, Newcastle-on-Tyne, and Glasgow, explains the earnest desire of the Committee of Management that more of them should be formed. The fact that 81 grants were made last year, no qualified applicant being turned away, proves the need for the Institution as well as the necessity of supporting it, and the best possible form of support is that of subscribing membership. We trust that all our readers will personally endeavour to make the E.T.B.I. more widely known, even if they have no other connection with it—that costs nothing, but is worth much—and we warmly commend it and its work to the whole industry as well worthy of encouragement and support.

Electricity Meters.

IN *The Times* of April 23rd appeared a letter from a consumer at Notting Hill Gate, in which he said that, believing he had not consumed the electricity he was charged for, he had his meters tested, with the result that the lighting meter was found to over-register by 4½ per cent. and the power meter by 5½ per cent. (Incidentally, too, he gave the test result of his gas meter, which was 16.28 per cent. fast!) We refer to this case not because we think that there are many cases of consumers having meters over-registering, but the reverse. The tendency, so far as the mechanical parts of a meter are concerned, is that the meter goes slow with length of time in service. Moreover, not only is there a tendency for meters to slow down on ordinary load, but also for meters not to start on one or two lights. The only places where the metering can be really accurate are where the undertaking has an efficient meter department, and where meters are left out on circuit for only a limited period; also where the meter readers have instructions to test the meters for starting, which can be done in a minute by turning on a light. It is perhaps in the smaller undertakings that meters are put in and remain for years, probably even till something goes flagrantly wrong. This is the more important since the smaller undertakings depend largely on a small sale of high-priced units, and units lost at 5d. or 6d. easily mount up to a considerable sum. Some undertakings invoice to consumers only about 75 per cent. of their output—some even less; losses in mains, &c., are, of course, included in the unmetered percentage, but there is every reason to think that this big margin of "lost" units might be materially reduced by a reorganisation of the metering arrangements of the undertakings.

Elsewhere in this issue we give some particulars concerning the meter-testing laboratory of the North Metropolitan Electric Power Supply Co. This rather suggests that the ideal to aim at, in order to obtain efficiency in dealing with large quantities of meters, is elaborate organisation rather than apparatus.

Tramways in 1924-25.

IN this issue we review the latest return relating to tramways and light railways (including railless traction systems) published by the Ministry of Transport, covering the year 1924-25. From the return it will be gathered that this "obsolete" system of transport is still doing a fair amount of business, having carried 4,620 million passengers during the period covered, about 177 millions more than in the preceding year.

The financial position, unfortunately, did not show an improvement. The ratio of working expenses to receipts rose from 77.74 to 79.10 per cent. (it was only 64.51 per cent. before the war), and the net receipts declined from 4.33d. to 3.80d. per car-mile. The total amount received from the rates was £521,801, while the undertakings contributed £281,732 to the rates, making a balance of £240,069 on the wrong side. Against this a sum of £52,803 was carried forward by the local authority undertakings after, in the aggregate, meeting all charges. It is necessary to bear in mind that these undertakings are not primarily profit-making concerns, and are designed to work to meet their expenses as closely as possible. The most interesting part of the return is probably that which classifies the municipal undertakings according to their financial results. Taking the numbers alone the position seems to indicate improvement, but in the aggregate there was a deficit of £282,907, as compared with a credit balance of £74,154 in 1923-24. One more undertaking was able to cover all charges, and show a balance, making a total of 99 out of 156 systems, while the undertakings which were unable to cover their working expenses were reduced from 11 to 8. In 1921-22 only 81 undertakings, out of 157, were able to cover all charges, while 14 failed to meet their working expenses. In that year, too, there was an aggregate deficit of £254,982.

Another point which should be considered when studying the return is the enormous influence of the L.C.C. result upon the whole. In 1924-25 the L.C.C. tramways received £237,836 from the rates, whereas in the preceding year they earned a substantial profit.

While the figures given in the return are not as satisfactory as they ought to be, we fail to discern in them any reason for making a clean sweep of tramways, quite apart from the question which would arise when arrangements had to be made to redeem the capital invested in tramway systems, which amounted to about 100 millions at the close of the period covered by the return.

On the other hand, we think that there is a case for a certain measure of protection against unlimited and irresponsible motor-omnibus competition in towns where an efficient tramway system has been built up.

The Problem of School Lighting.

THE discussion on school lighting, opened by Dr. James Kerr at the meeting of the Illuminating Engineering Society on April 29th, was attended by many representatives of the medical and scholastic professions. Dr. Nash, who presided, is himself chairman of a committee of the Medical Officers of Schools Association which is now studying the subject; and of those who joined in the dicussion several were themselves on the staff of technical institutions and able to speak from the teacher's standpoint. Dr. Kerr's paper gives the impression that the original report of the joint committee of the Illuminating Engineering Society, which has influenced the methods of leading educational authorities considerably, still contains in substance what is necessary for adequate school lighting. Only on two points were modifications suggested: an increase in the illumination to 5-7 foot-candles, and a limitation of the brightness of lighting units to 3 candles per sq. in. when located within the direct range of vision. These requirements can be easily met with modern fittings, of which examples were shown at the meeting. Further discussion between experts would probably not add greatly to our knowledge of the essentials of school lighting. What is needed is to bring the correct methods before the notice of educational authorities and medical officers of health. From this point of view the meeting served its purpose well. Good lighting received the endorsement of Mr. J. B. Lawford, one of the most eminent ophthalmologists in this country. Representatives of educational bodies, whilst explaining their own difficulties, showed themselves in complete accord. The practical need, very clearly put by Dr. Nash in winding up the discussion, is to induce authorities to meet the cost of proper methods, and the Society, in creating an atmosphere sympathetic to the claims of good illumination, is doing good work.

The General Strike.

AS we are preparing these pages for the press, a "general strike" throughout the country has begun which embraces within its scope certain Trade Unions associated with the printing trades; almost inevitably, therefore, for the first time in its career of more than half a century, this journal will be prevented from appearing at the normal time. We trust that our readers will absolve us from reproach on account of this lapse, seeing that it is not in our power to avert it.

With regard to the strike itself, we can only say that we look upon it as a national misfortune of the first magnitude, which will have the gravest consequences; it is the more to be regretted in view of the fact that trade was distinctly reviving, unemployment was decreasing, and the prospects were brighter than they had been for years. That a speedy solution may be found for the nation's difficulties will be the earnest hope of every patriotic citizen.

Trolley Omnibuses at Ipswich.

The Corporation Fleet made by Messrs. Ransomes, Sims & Jefferies, Ltd.

THE Ipswich electric tramways were opened in November, 1903. The system comprises a little over eleven miles of route, only a portion of which is double tracked, the actual length of single line being a little over fifteen miles.

About three years ago the Corporation was faced with the necessity of either relaying practically the whole of the permanent way, or adopting some other method of public passenger transport in the town. While the tramway system had never been really remunerative, it would be still less so when burdened with the heavy expenditure which the relaying of the track would entail. Accordingly, on the score of economy in operating cost, it was decided to substitute railless electric trolley 'buses.

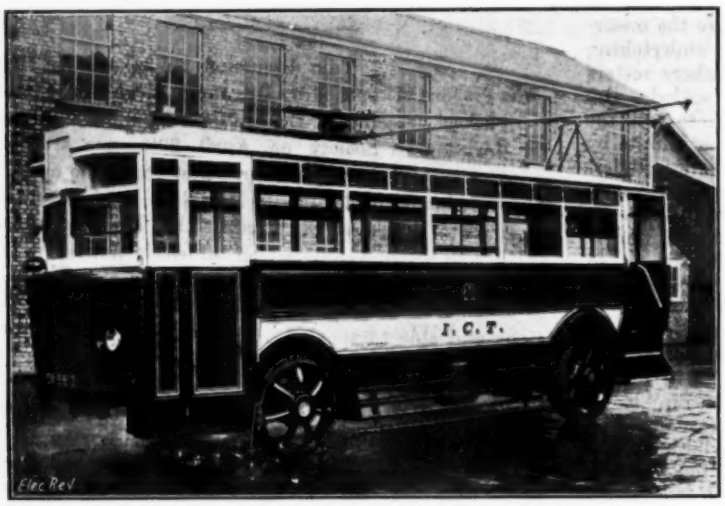

Fig. 1.—Ipswich Corporation Electric Trolley 'Bus.

In order to try such 'buses on a section of about two-thirds of a mile in the centre of the town between The Cornhill and the railway station, which had been run for years as a shuttle service, three electric trolley 'buses were hired from Messrs. Railless, Ltd., and after a few months' use they were purchased, their operation having demonstrated the suitability of this class of vehicle. Last year, therefore, having secured the necessary statutory authority, the Corporation embarked upon the larger scheme of abolishing the tramways in sections. Meanwhile, a further trial had been made between The Cornhill and the Wherstead Road terminus, for which purpose a trolley 'bus of a new design had been supplied by Messrs. Ransomes, Sims & Jefferies, Ltd. Later trials were also made of vehicles loaned by Messrs. Tilling-Stevens and Messrs. R. Garrett & Sons, Ltd.

As the result of inviting tenders for the thirty 'buses required for carrying out the substitution in the eastern district of the town, orders were placed with Messrs. Ransomes, Sims & Jefferies and Messrs. Garrett for fifteen 'buses each, and the Orwell works have already delivered ten of the new 'buses, which incorporate special features.

The chassis is provided with a single motor, capable of developing 50 b.h.p. on the standard rating of the British Engineering Standards Specification for Traction Motors (namely, a run of one hour, during which the temperature of any part of the motor must not rise above that of the atmosphere more than 75 deg. C.), but on the test bed it is called upon to develop 100 b.h.p. for a short while. The controller is of the straight series type, the main drum being operated by a foot pedal, and the reversing drum, which is mechanically interlocked with the main drum, by a lever on one side of the driver's seat. A dial on the dash board has a pointer connected with the controller which indicates to the driver the position of his main-drum contacts at any moment. The power developed by the motor is transmitted to the back axle by a tubular propeller shaft of special steel provided with enclosed universal joints at each end, the couplings of these joints, where attached to the motor shaft and to the worm shaft on the back axle, being provided with plines. The back axle itself is a fine forged-steel casing dished in the centre to receive the worm wheel, differential, and worm unit, which is mounted on the cover, the latter closing in the dished space in the centre of the axle; at each end of the axle a cast-steel bracket carries the extra large brake shoes and their cams.

Each rear wheel is provided with two separate brake drums of pressed steel, both the rear and front wheels being of the cast-steel hollow-spoke type. The rear wheels are provided with twin solid tires, and each front wheel with a single tire.

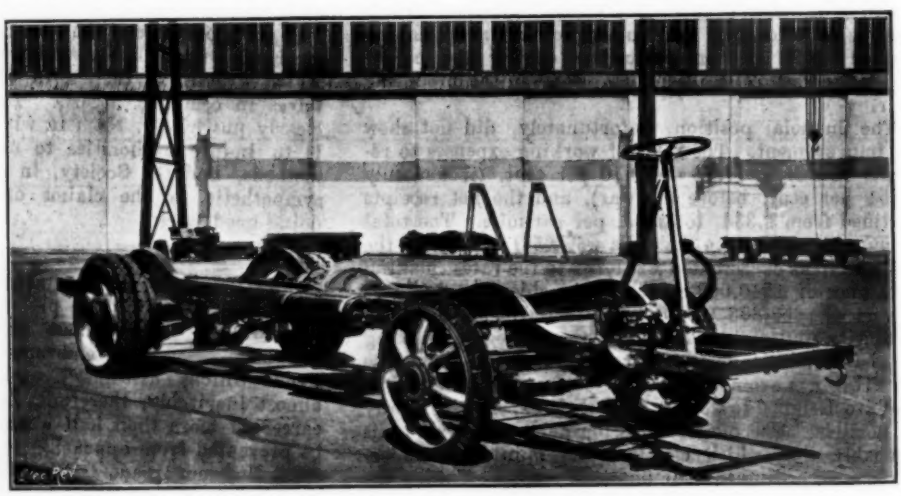

Fig. 2.—Trolley 'Bus Chassis at the Orwell Works.

The brake gear is interesting in so far as the foot brake is operated by compressed air, this equipment having been supplied by the British Air Brake Co. The compressor, and the Ransomes motor which drives it, are mounted on the near side of the main chassis member; the rotary compressor, made by Messrs. Reavell

and Co., is of an entirely new design, and its motor is controlled by an automatic switch in the driver's cab, which is operated by the piston in a cylinder that is controlled in turn by the pressure in the brake reservoir; the working limits of air pressure in the reservoir are 30 lb. and 40 lb. The means of applying the brake is a foot-operated valve on the floor in front of the driver and, in addition, there is a brake operated by a hand lever, which is used in emergency and for holding the vehicle when standing.

The front axle is a drop forging of special steel. The stub axles are so arranged in conjunction with the design of the front wheels that an imaginary projection of the centre line of the swival pin nearly intersects the point of contact of the tire on the roadway, a feature which is characteristic of these new 'buses and assists steering. Specially noteworthy is the excellent springing; each spring is 5 ft. long, and at its forward end is held by a pin passing through a solid eye on the top plate of the spring, and supported in a bracket attached to the main chassis member. Attached to the rear end

Fig. 3.—Interior View of 'Bus.

of the top spring plate is a wearing piece, which bears underneath a roller supported in a bracket attached to the chassis frame, allowing the maximum of freedom for the working of the spring; the vehicles are very smooth riding.

All the bearings throughout the vehicle are of the roller type, including those of the motor. With the exception of the naves of the front wheels and the dished part of the back axle containing the worm gear, where provision is made for oil lubrication, all other points are grease lubricated by means of the "Tecalemit" grease-gun system.

The motor is of Messrs. Ransomes' latest design, and is induced air cooled; the air enters at the forward end of the motor through a special hood and protected opening, and it leaves at the rear end where somewhat different hooding is provided to prevent splashed water (for example, when washing the 'bus) getting into the motor. The motor is so attached to the pressed supporting members that by taking out 8 bolts it can be entirely dropped from the chassis frame for overhaul or replacement; it is equally easy to remove the armature from the motor without detaching the carcase of the latter from the chassis framing.

The bodies of these new vehicles are of somewhat special design, doors being provided for ordinary use at both the front and rear. The front door is in front of the near side wheel, which enables part of the space usually taken up by the driver's cab to be utilised, and when operated as a one-man 'bus enables the driver to receive passengers' fares and issue tickets with greater facility. The intention of the Corporation is to operate the 'buses as one-man vehicles during the slacker periods of the day, but during traffic rush hours to place a conductor on each 'bus, when passengers will use the rear entrance, which is fitted with a pair of folding doors on the near side; they are mechanically connected with the steps, so that when the doors are closed and bolted the steps are folded in the upright position. The front door folds up, and is operated by a lever by the driver.

The interior seating capacity is thirty passengers, with the maximum of standing capacity during rush hours. The floor level of the 'bus when fully loaded is 29 in. at the front-door entrance and 33 in. at the rear-door entrance. The exterior is painted green and the interior decoration is fumed oak and white enamel; the seats are upholstered in green leather cloth, and space is provided between the near side longitudinal seat and the front door for a small quantity of passengers' luggage. The driver is completely screened off from the passengers and has a separate entrance door to his cabin from the front offside.

The interior of the 'bus is illuminated by no fewer than 11 ceiling bulk-head fittings. The destination indicators have been patented by Mr. Clarke, of the Corporation Tramway Department, and one of the accompanying illustrations shows the neat arrangement of the front head-lights, which are so housed that they do not project beyond the surface of the front dash.

The weight of the complete chassis is 3½ tons, and that of the complete 'bus ready for the road is 5 tons 19 cwt. The maximum speed with a full load, on the level, is about 22 m.p.h., and up Bishop's Hill (of which the steepest gradient is 1 in 11) it is about 12 miles per hour. One of the tests is to stop and start when fully laden on the steepest point of the hill, and either brake will stop the 'bus when going at 20 m.p.h. fully laden in from 16 to 20 yards on the level.

In conclusion, it may be remarked that the Company's five works cover 40 acres, the Electric Vehicle Department being accommodated in the factory erected during the war for the manufacture of aeroplanes. Our thanks are due to the directors of the Company for allowing us to see the 'buses in production in the extensive Orwell works and to take part in a demonstration run in the historic old town of Ipswich.

Earth Losses in Radio Sets.

How to Secure a High Efficiency.

By PAUL D. TYERS.

THE necessity of a good aerial has recently been emphasized in these columns. It must not be imagined, however, that the aerial is the only important factor determining the performance of a set, however good it may be. The aerial system includes the earth connection, and a really efficient earth connection is again a vital necessity. In the writer's opinion it is no exaggeration to suggest that at least fifty per cent. of the earth connections in use at the present time are not efficient. Let us then briefly consider the most important points which should be observed when making an earth connection.

The lead between the set and the actual point of connection to the earth should be as short as possible. Too fine a size of wire should not be used for the earth lead, nothing smaller than about 16 or 18 gauge really being suitable. It is further advantageous to use an insulated wire for the earth lead, particularly when the set is to be used on the shorter wave lengths.

There are really two ways of making connection to the earth; the first is by burying a conductor of an

appreciable area, and taking a lead from it, while the second is that of making connection to some conductor which is already buried, such as a water pipe. Neither method is more efficient than the other, nor are they equally efficient. The efficiency depends upon the actual conditions of each specific example. If a water pipe is employed, only a main lead pipe should be used, and the wire should preferably be soldered to it, rather than connected by some form of earth clip. Pipes containing screwed joints, such as a gas barrel, should not be employed. If it is found that the water pipe to which an earth connection is to be made travels round the house before going into the ground, it will probably give worse results than a connection consisting of a plate buried directly under the aerial, or near the receiver.

If an efficient connection is to be made, it is essential that the ground should be fairly moist. This necessitates burying the earth plate as deeply as possible. The area of the plate should be at least several square feet, fairly thick copper foil being very useful for the purpose. Where the earth lead is connected to the plate, it is preferable to employ a soldered joint, taking care to remove any traces of flux used in the soldering operation, and finally covering the joint with paint or some form of fairly soft wax, to exclude any moisture from the contact between the two dissimilar metals, which might give rise to electrolytic action from moisture in the ground. Other earthing devices are now on the market in the form of earth plates or mats, or earth tubes. The writer infinitely prefers, as a result of measurements taken, the use of an earth plate to the use of an earth tube or spike simply driven into the ground. The writer has recently examined a number of receivers fitted with earth tubes, which were giving very poor results, the trouble being due to the fact that the earth connection was totally inefficient. It must not be imagined, however, that the earth tube itself is inefficient, the success depending upon the manner in which it is employed. If the tube is simply driven into the ground, it follows that only approximately the lower half of it is in moist surroundings, and accordingly its effective area is halved. The dry earth over the surface of the earth is of little use in making a connection. If the ground happens to be permanently very moist almost to the surface, then substantially the whole area of the tube is useful, but this is seldom the case. When an earth tube is driven in level with the earth, it should be knocked in at least a few more feet with a piece of metal rod of some description, so that the whole area of the tube is completely surrounded with moist ground several feet below the surface. The writer recently found an earth tube driven into a gravel path. Needless to say, the results were very poor indeed.

The effect of a bad earth on a receiver is not only to weaken the signal strength; it also tends to flatten the tuning, and makes the set difficult to manage. It is not at all unusual to be able to increase the signal strength by more than 50 per cent. simply by substituting a good earth connection for one indifferently installed. By paying attention to small points of this nature, the trader will do much to gain the confidence of his clients.

The Settlement of Technical Disputes.

(From our Legal Correspondent.)

It sometimes occurs to those who have the misfortune to be involved in litigation which concerns machinery, or the discussion of highly technical matters, that our recognised tribunals are not best fitted to settle the rights of the parties. Indeed, one might almost put it higher than this, and say that technical people generally are so averse to the risk of being concerned in a lawsuit in the strict sense of the term that they almost invariably have recourse to arbitration. It is not too much to say that hundreds of disputes are settled by this means in the course of a year; and, apart from all else, courts of arbitration are a dire necessity. In the time at their disposal, His Majesty's judges would be wholly unable to cope with the large volume of litigation which is disposed of by these domestic tribunals.

But there remains the question—Is a reference to arbitration best obtained by the clause which is now customarily inserted in technical agreements? Take, for example, that which provides for a reference to two arbitrators—one to be chosen by each party, and an umpire appointed by them in case of difference.

This form of clause necessitates the appointment, in the first place, of two arbitrators who, in the nature of things, are generally partisans from the outset. Failing agreement between them, they appoint an umpire. In the vast majority of cases they "agree to differ" at once and appoint an umpire, who presides at the hearing. The hearing may take a long time. The arbitrators and the umpire are generally busy men, who must be adequately compensated for their services. When the award is made, it need not be published or given up to the parties until the arbitrators' fees are paid; and those fees may be, and often are, wholly out of proportion to the amount in dispute. True, the unsuccessful party will generally be ordered to pay them; but they must be paid, in the first instance, by the party who takes up the award. Having taken it up, he may find that his opponent is directed to pay the fees of the arbitrators and all the costs of the reference. But it is one thing to get an order for John Brown to pay a certain sum of money; it is another and a wholly different thing to get the money. John Brown may "have no wool on his back."

We start, then, with the initial difficulty that he who goes to arbitration may have to pay not only his own lawyer, but the tribunal itself. In a suit at law he may have to pay certain judicature fees; but he is not called upon to pay for the services of a judge.

The curious and cumbersome practice of selecting an expensive tribunal, consisting of two arbitrators and an umpire, may have had its origin in the fact that the parties cannot be certain that, when trouble arises, they will be able to agree upon a single arbitrator; but whatever the origin of the procedure, contracts involving what is, from some points of view, a needless waste of money, have come to be common form. They are signed without either party inquiring, or even pausing to consider, whether there is any alternative; whether disputes, if they arise, cannot be settled in some other way. Least of all does it seem to occur to those who sign such documents that the law of the land may provide for the determination of disputes in a manner which is just as satisfactory and rather less expensive than an ordinary reference to arbitration.

Can those who wish any disputes in which they may be concerned to be settled by arbitration, secure that form of trial before one independent arbitrator? They frequently do so by providing that the reference shall be to an arbitrator appointed (say) by the President of the Institution of Electrical Engineers. That is one satisfactory method. But there is another provided by law. It is to be found in the Arbitration Act, 1889, which states (by S. 5) that where a submission provides that a reference shall be to a single arbitrator and the parties do not concur in the selection of an arbitrator, the Court may make the appointment.

In view of this state of the law, it is sufficient to so frame the arbitration clause as to require the services of a single arbitrator. Failing agreement as to a particular person, either party may apply by what is called an originating summons to a Master in Chambers, who will make a suitable appointment. His discretion

in the matter is entirely unfettered. If it is an engineering case he may appoint an engineer; or if it is a building case he may appoint an architect; but he will generally select some person whom he knows to be skilled not only in his own profession, but in the settlement of disputes. His fees must, of course, be paid by the parties—and will generally have to be paid by the unsuccessful party.

Nor (it is submitted) should those who are involved in a technical dispute adhere too strictly to the view that it will best be adjusted by a technical expert.

It is the general experience of mankind that the best tribunal for determining a question of fact is one presided over by a lawyer accustomed to hear and weigh the value of evidence. He can hear the testimony of experts on one side and experts on the other on a purely technical point and form an opinion as to who are most likely to be correct. He will not always be right; but that is not the point. Is he not *more likely* to be right than a man who has never been trained to sit in judgment? Your expert who takes a biased view on a particular scientific theory or problem would not be the proper person to decide a case which involved the application or consideration of that theory or problem. He would be *ex hypothesi* prejudiced. One recalls a case in which the point for decision was whether a certain picture was or was not the genuine work of an old master. The parties assembled with their witnesses—artists of great eminence—to have the matter determined. The judge, however, intimated that he would prefer to call in an artist of his acquaintance to examine the picture and report to him as to whether the picture was genuine or not. The parties agreed to this course. The story goes that the artist reported that the picture was genuine. Straightway the successful litigant took a taxi and brought this genuine "old master" to a well-known dealer who could find him a customer amongst the millionaires of America. But alas! the dealer refused to hang the picture—pronouncing it a fake!

Again, it should not be forgotten that there are many amongst the lawyers of the present day—to be found within a radius of a few hundred yards from Temple Bar—who are well qualified to sit in judgment in a technical case. The bar of England always has within its ranks men who have spent part of their professional youth in other professions; and even where he has had but a smattering of a technical education, it is marvellous how the man with a legal mind can bring himself to understand the scientific questions which arise in a case. Even lawyers with no technical experience at all have been known to shine in scientific cases. One of the great judges of the past—Lord Parker—was called upon to decide a case in which the whole subject of wireless telegraphy had to be inquired into. His court assumed the aspect of a physical laboratory for about a month. All the greatest experts were summoned before him, and he gave a decision so masterly that it was never appealed from! One of the experts told the writer at the end of the case that of all those who were present in court, there was no one who knew more of the subject than the Judge on the Bench!

A genius like Lord Parker does not make his appearance more than once in a lifetime; but it is hoped that enough has been said to show that in selecting a tribunal for the settlement of technical disputes, the technical man should not wholly ignore the possibility of submitting his case to the decision of a lawyer.

Investigations in Commercial Testing.

Some Noteworthy Applications of the Megger Testing Set.

By G. TAGG, B.Sc.

THE testing of the insulation of electrical equipment, whether it be cables, generators, switchgear, transmission line insulators or house wiring, is of very great importance, and it is the practice of well organised supply authorities to keep card records of the value of the insulation of the various components of their plant. The purpose of these records is to make apparent any deterioration of the insulation, since it is not so much a high value of insulation that is necessary, as constancy during the course of time. All electrical engineers are familiar with the ordinary use of the Megger testing set, but in view of modern requirements, the higher standards demanded, and the necessity of keeping records which should be comparable over a number of years, a few notes on the extended use of the Megger are desirable.

Many years ago telegraph engineers, especially those connected with submarine cables, experienced considerable trouble due to extraneous current affecting their testing instruments; and although the instruments were very highly insulated, it was not found possible to overcome the trouble until Price introduced his guard wire, which had the effect of by-passing the leakage currents so that they did not affect the instruments.

When Mr. S. Evershed designed the Megger testing set some 25 years ago, he took advantage of Price's simple but ingenious arrangement to guard the sensitive indicating movement of the Megger testing set from leakage currents, and thus to secure that the Megger would only indicate the insulation of the object connected to its terminals. The diagram fig. 1 shows how the Price guard system was applied. In this diagram it will be seen that any leakage current passing between the line and earth terminals is trapped by the guard ring and goes back to the generator by a direct path and not through the instrument movement.

For ordinary insulation tests up to 100 megohms, such an instrument is quite satisfactory, but for higher values and special conditions the guard system is connected to an additional terminal marked "Guard" as shown dotted in fig. 1. This enables the operator to guard the apparatus he is testing and also to determine the individual values of several parallel paths by the application of a few simple formulæ. Before deducing these formulæ it is necessary to make the following assumptions:—

(1) The resistances concerned can be treated as separate resistances not in any way interconnected with one another.
(2) The values of these resistances are constant.
(3) The resistances are not altered by the change in direction of the current passing through them.

Consider what happens when three resistances represented by x, y and z are connected, x between the line and earth terminals, y between the line and guard terminals, and z between the guard and earth terminals, as shown in fig. 2. Suppose k equals the total internal resistance of the current circuit, that is equals $CR + C$. Let the instrument reading be a.

The current circuit is shunted by the resistance y, and hence the proportion of the current through x which passes through c is $y/(y+k)$. But the instrument reading is inversely proportional to the current through the current circuit, as when x is nothing the current is a maximum, and when x is infinity the current is zero. Therefore the instrument reading is increased in the ratio $(y+k)/y$, and so

$$a = x.(y+k)/y \quad \ldots\ldots\ldots\

current circuit as it will pass from the guard terminal straight back to the negative side of the generator. Also the pressure circuit has no effect as none of the current through it passes through the current circuit.

Now reverse the line and earth terminal connections and let the instrument reading be b. This reversal has the effect of changing the positions of y and z relative to the instrument and so by a similar reasoning to the above

$$b = x.(z+k)/z \quad \ldots\ldots(2)$$

Return the line and earth terminal connections to their original positions and reverse the line and guard terminal connections. This has the effect of changing the positions of x and z relative to the instrument, and so if c is the reading

$$c = z.(y+k)/y \quad \ldots\ldots(3)$$

Equations (1), (2), and (3) can now be completely solved for x, y and z, and give

$$x = (bc-ak)/c \quad \ldots\ldots(4)$$

$$y = k(bc-ak)/(ac-bc-ak) \quad \ldots\ldots(5)$$

$$z = (bc-ak)/a \quad \ldots\ldots(6)$$

The above equations involve the total resistance of the current circuit of the Megger testing set being used, which can always be obtained from the makers for any particular instrument if the serial number is mentioned. As an example a 500-volt Megger reading up to 1,000 megohms has a value of k of .3 megohm, while the 1,000-volt instrument has a resistance of .6 megohm.

These equations have been tested not only by using constant wire resistances, but also by experiments on porcelain insulators where the resistances of the paths have been fairly accurately known, and it has been found that the results obtained from these equations are well within the accuracy with which the instrument can be read.

We will now consider the practical application of these formulæ.

Insulators when wet or dirty possess a considerable leakage path over the surface, and there is accordingly a leakage resistance in parallel with the true resistance of the insulator. This has the effect of reducing the apparent resistance of the insulator, and it is difficult to differentiate between a faulty insulator and one which has a low insulation value due to the presence of moisture or other matter forming a leakage path. The result of a test on an insulator would depend not only on its own condition but also on the presence of these leakage paths if a test were taken in the usual manner. In fig. 4 let A represent the overhead line, and B the insulator support.

Then suppose a guard ring were placed round the insulator in some such position as C. This will divide the leakage path over the surface between A and B into two portions. The resistance of that part between A and C may be represented by y, and the resistance of that part between B and C by z. Then if the true resistance of the insulator is represented by x, and A is connected to the line, B to the earth, and C to the guard terminals of a Megger testing set, the diagram of connections will be similar to that in fig. 2.

If the procedure outlined above is then followed, the three equations (4), (5), and (6) will give the values of the true resistance of the insulator and of the two portions of the leakage path. In testing an insulator it is probable that the resistance k will be negligible compared with x, y and z, and so the amount of current which is shunted from the current circuit will be too small to have an appreciable effect on the instrument reading. If this is the case, when the connections are as shown in fig. 2, the instrument will read directly the value of x, the true resistance of the insulator.

This enables faulty insulators to be differentiated from those with considerable leakage paths.

The above method may also be applied to the testing of two-core cables. In the cable shown in fig. 5 there are three resistances concerned, namely, the resistance between the two conductors and the resistance between each conductor and the sheath. Let the resistance between the two conductors A and B be represented by x, that between A and the sheath S be represented by y, and that between B and S by z. Then if A is connected to the line, B to the earth, and S to the guard terminals of a Megger testing set, the diagram of connections will again be similar to that shown in fig. 2, and the above method may be applied. The three equations will then give the values of the resistance between the two conductors and the resistance between each and the sheath as separate values.

The testing of multi-core cables is rather more complicated, due to the presence of more than two conductors. The resistance between any two conductors may, however, be determined by connecting one to the line, the other to the earth terminals, and all the remaining conductors and the sheath to the guard terminal. Using the above method, equation (4) then gives the resistance required. The values obtained from equations (5) and (6) are of little use as they represent the resultant of a number of resistances in parallel.

To determine the resistance between any conductor and the sheath, connect the conductor to the line and the sheath to the earth terminals, and all the remaining conductors to the guard terminal. If the method is again applied equation (4) will give the value required.

House wiring may also be tested by the above method. Consider two wires l_1 and l_2 in fig. 3. Then there is a resistance between them which may be represented by x, and also resistances between each and earth which may be represented by y and z respectively. Then if l_1 is connected to the line terminal, l_2 to the earth terminal, and the earth to the guard terminal of a Megger testing set, the connections will be similar to those shown in fig. 2. The equations (4), (5) and (6) will then give the resistances required.

The instruments which are generally used for testing house wiring do not possess a separate guard terminal, but connection can be made to the guard ring by pushing a thin piece of metal or the flattened end of a piece of wire in between the guard ring and the line terminal insulator. It is advisable to apply the testing pressure for a few moments before taking the readings to allow for the effect of electrical osmosis.

From the above it will be seen that the use of the guard terminal, and it may be, of a guard ring, simpli-

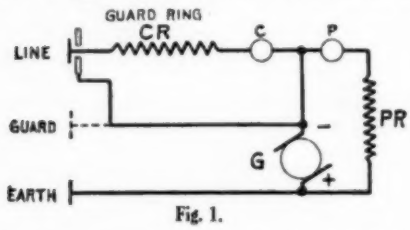

Fig. 1.

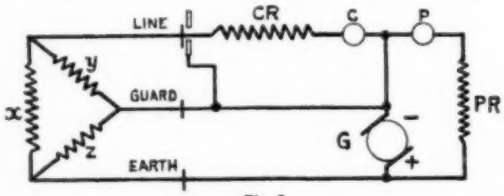

Fig. 2.

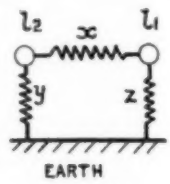

Fig. 3.

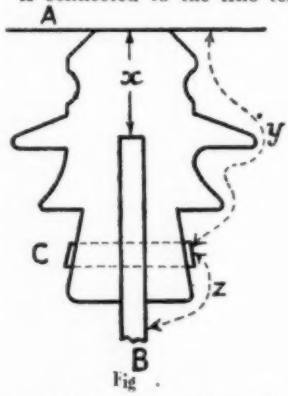

Fig 4.

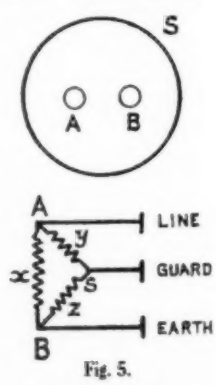

Fig. 5.

fies the testing of many portions of electrical equipment, which, if tested in the ordinary way, are likely to give erroneous results. In most cases the instrument will be direct reading because the resistance of the current circuit of the Megger testing set will be negligible compared with the resistance under test, thus making the current shunted from the current circuit extremely small. The above method is particularly useful when testing insulators, as leakage resistance may be separated from the true resistance. It should be noted that the method will only show up faulty insulators if the faults are in such a state that they will reduce the resistance of the insulator.

If the insulator were cracked, for example, a test in very dry weather would not show up the fault, as the crack would be filled with dry air which is itself a good insulator. The fault would only show up if the crack were filled with moisture or dirt.

Testing without using a guarded system is rather unsatisfactory, as resistances are introduced of which it is not easy to take account, and it is accordingly advisable always to use a guarded circuit where possible.

Modern Electric Lifts.

The New Department-Store Control Installation at Harrods's Stores.

A CONSIDERABLE and important advance on what had previously been done in the production and operation of electrically-driven lifts is represented in the development, by Messrs. Waygood Otis, Ltd., of the department-store control system of electric-lift operation, by

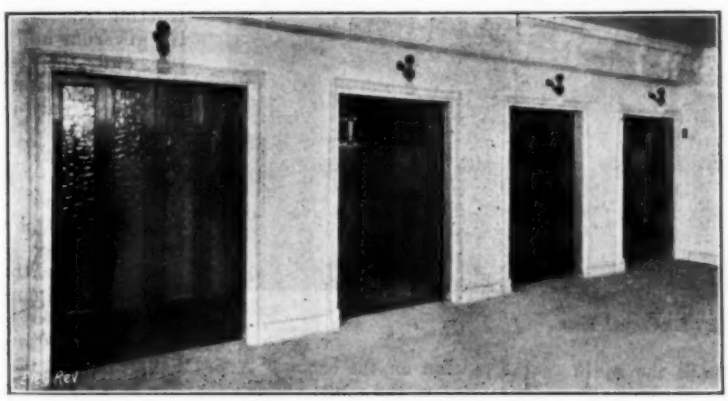

Fig. 1.—Lift Bank, Top Floor.

which, it is claimed, a service increase of 50 per cent. is obtained above that by lifts employing the ordinary resistance car-switch control. The principal feature of this new method of control is multi-voltage supply regulation of the driving motor. This machine is supplied with energy from a motor-generator and the elevator movement is governed by automatically regulating the pressure of the generating unit, which is directly supplied to the armature of the driving motor.

Some particulars of a recent installation of electric lifts employing this new control system will probably prove of interest to most electrical engineers. The equipment referred to may be seen at the Brompton Road stores of Messrs. Harrods, Ltd., and has been working since Christmas last with satisfactory results. The installation consists of a bank of four identical lifts arranged side by side, fig. 1. Each is operated by a 25-h.p. motor, fig. 2, driven from a motor-generator of the same capacity. A feature of the apparatus is the employment of a traction sheave for the lift drive. The driving portion of the sheave is mounted directly on the armature shaft, and, its diameter being only slightly larger than that of the armature, the lift speed closely approximates to the peripheral speed of the driving rotor. As already mentioned, the speed regulation of the motor, and in consequence the lift car, is effected by variation of the supply pressure from the generator, which ranges from 200 V to 12-15 V, representing the maximum and minimum motor speeds of 102 and about 7 r.p.m. The brake drum is an integral part of the armature cylinder and the spring-controlled brake shoes are held in the off position by brake magnet coils mounted on the motor frame. The motor bearings are provided with chain lubrication.

The main control medium between the car and the generator consists of a pawl-coil unit mounted on, and free to move along, a screwed, vertical, steel rod which is tape driven from the car, and as the rod revolves the pawl device travels up or down the thread of the rod, according to the direction of rotation of the rod, the limits of travel representing those of the actual car between its top and bottom stages. Two pawls are employed, one at each end of the coil, and each works in co-operation with a separate selector rod. Each rod is equipped with four collars which are spaced out, in relation to the travel of the pawl unit, so as to represent the floor stages of the lift, four up on one rod and four down on the other. The pawls are controlled from the car to engage or disengage with the necessary collars when required. The rods each actuate four selector switches controlling four of the five governing relays for the pressure regulation. As the car, and with it the pawl unit, rises or falls, the pawl corresponding to the direction of the lift travel is operated to engage the collar representing the next floor to be reached when the coil arrives at the necessary position. The coil continues to travel on engaging with the collar and lifts or lowers the rod according to the direction of

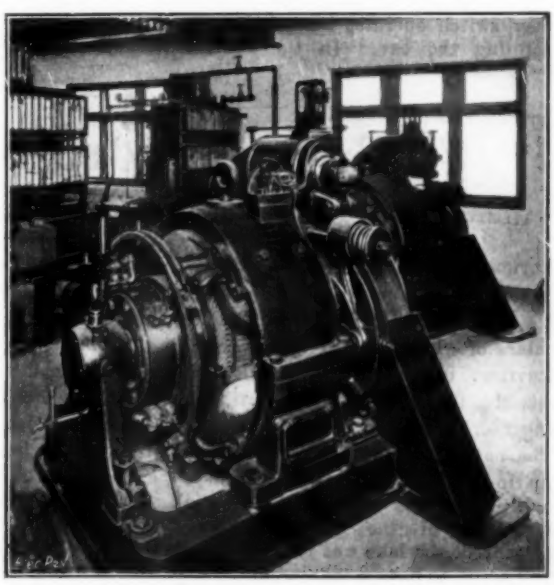

Fig. 2.—Light-Driving Motor.

motion of the lift. The rod movement actuates the selector switches and the car is stopped. The reverse operation takes place when it is required to start the

elevator, the pawl being disengaged from the collar. Normally the car reverses only at the top and bottom stages, but an emergency direction-changing device is installed for operation at the intermediate stages, should that be necessary.

The fifth pressure-varying relay is only called into service when the load on the lift is severe, and it is automatically and electrically operated. The relays are controlled by reactance coils to give them the correct working sequence. They are mounted on the control board, fig. 3, which also accommodates the main relay equipment, directly controlling the motor-generator switchgear and field-reversing relays for the necessary direction control of the motor. A small auxiliary relay is operated from the car, and in turn controls the main relay and a d.p. switch which excites an automatic rheostat, interlocking relay, and the main control devices.

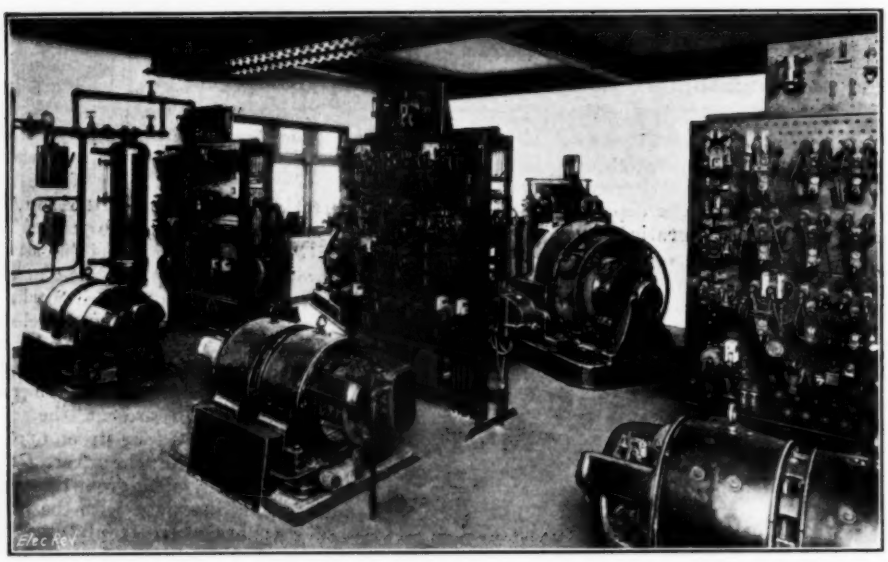

Fig. 3.—Lift-Control Room.

An operating panel is installed in a convenient position in the car and contains the operating handles and the emergency and safety control switches. The auxiliary relay on the control board is operated by a Yale-key switch, a small lamp indicating when this is on. A lever switch operates the pawl unit, thus starting or stopping the car. In the normal position this is arranged with a dead-man action. A safety switch under a glass face can be operated to cut the whole supply off in the case of failure.

Both the car and hatchway doors are operated by means of air pressure which is electrically controlled by a small motor situated on the roof of the car. The motor opens a valve governing the air supply and is brought into operation at the half-way position of the lever switch. The air supply is maintained between the required limits of pressure by means of an electrically-driven pump, a piston switch that automatically operates the motor being actuated under the air pressure. The driving and controlling machinery for the four lifts is installed in a special 2-storey room located on the roof immediately above the lifts. The motor generators, motors, control boards, selector-switch equipment and the air-pump gear are located in the top storey, fig. 3, and the lower floor accommodates the lower part of the traction sheave, the lift governor apparatus and the tape-driving equipment for the pawl-unit spindle.

The elevators are self-levelling, and maintain the car floor at the hatchway level during the loading operations. As the loads increase the self-levelling device compensates for the tension on the cables. A particular feature of the lifts, due to the multi-voltage control, is the rapid and smooth movement of the car. The usual "up" and "down" hall lanterns above the car doors signal to waiting passengers the approach of the car and indicate when it is stopped at the landing. If desired an annunciator may be installed in one or more cars and signal buttons in the halls for night service.

In conclusion, we are indebted to Messrs. Waygood-Otis, Ltd., and Messrs. Harrods, Ltd., for their courtesy in giving us facilities to inspect the installation.

A Swiss Hydro-Electric Installation.

Some Details of the Lake Tremorgio Plant.

ALTHOUGH the hydro-electric station which was completed last year near Rodi, in Southern Switzerland, for the Società Officine Elettriche Ticinese, and some particulars of which were recently given in the ELECTRICAL REVIEW, only so far comprises a single 15,000-h.p. set, the installation is interesting owing to the many engineering difficulties which have had to be overcome. The power is derived from Lake Tremorgio, which lies up in the snow at an altitude of 6,000 ft. above sea level, and which is mainly fed by the Lagasca stream, a tributary of the River Tessin. When carefully measured, the lake was found to cover an area of about 670 acres, to have a maximum depth of roundly 180 ft., and an approximate capacity of 2,420 million gallons of water. Following the preliminary surveys, it was decided to reduce the depth of the lake by about half and its capacity to about 1,687 million gallons.

Owing to the steep sides of the lake being usually covered with snow, and the fact that avalanches have to be contended with, it was decided to draw the water from the lake by a tunnel, which commences at a point about 85 ft. below the lake level, and extends through

Fig. 1.—Rodi Hydro-Electric Station.

the mountain for a distance of 783 ft. The first 205 ft. of the tunnel practically forms an extension of the lake, for at that point, at the bottom of a vertical shaft 120 ft. deep, sluice gates have been interposed. The lake end

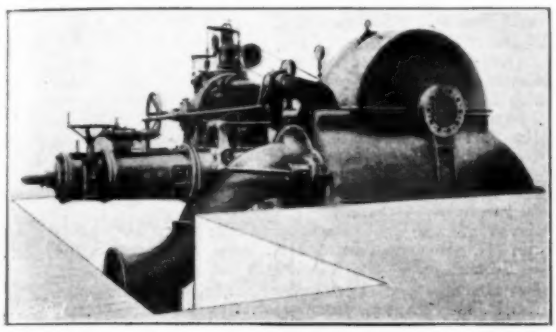

Fig. 2.—Pelton-Type Turbine.

of the first portion of the tunnel is oblong in section, this being followed by a part which has straight sides and bottom with a rounded top, the width varying from 3 ft. 11 in. to 4 ft. 6 in., and the height from 4 ft. 6 in. to 5 ft. 2 in. The portion of the tunnel behind the sluice gates is circular in section, the diameter ranging from 4 ft. 11 in. to 5 ft. 11 in.; part of it is lined to prevent leakage, with cement, and part with "Gunite."

At a point on the mountain side where the tunnel ends, 5,877 ft. above the sea, the water will be diverted into two conduits, only one of which, however, is at present installed. At this point a water-inlet control house has been established, provision being made both for hand and remote—from the power station—control. The conduits are of welded steel, and are partly laid in tunnel and partly in the open, although in many places, owing to the risk of avalanches, a protective covering for the pipes has had to be provided. The head between the control house and the power station is 2,775 ft. The conduit pipe is, however, 5,179 ft. in length owing to various turns in its direction being necessary. The average angle of slope of the pipes is 68 per cent., while in some portions the angle reaches 230 per cent. It will thus be readily realised that the work of construction was extremely arduous, necessitating the construction of both a temporary cable railway and a cable ropeway. Indeed, even for Switzerland, the steep angle of 230 per cent. is regarded as unusual.

The conduit is divided into four sections, the diameter ranging from 27.5 in. at the top down to 21.6 in. at the bottom, the thickness of the pipes increasing proportionately from 7 to 29 mm., while, in order to prevent rust, the pipes throughout their entire length were given a coating both internally and externally of asphaltic tar.

The power station is located near the village of Rodi; the building, fig. 1, which has been designed for easy extension, is in the Roman style, and of stone from the local quarries. At present the floor area is 64 ft. by 24½ ft., amply sufficient to contain a 15,000-h.p. Pelton-type turbine, fig. 2, constructed by Escher Wyss and Co., of Zurich, driving at 750 r.p.m., a 10,000-kVA, three-phase alternator built by the Brown, Boveri Co., of Baden, the current being generated at 8,400 V, 50 periods. The plant also includes a Brown, Boveri transformer, which steps up the current for transmission purposes to 50,000 V.

Fig. 3.—Bottom Conduit Section.

Fig. 4.—Conduit Erection.

Figs. 3 and 4 show, respectively, the bottom section of the conduit, and the conduit being fixed at an angle of 230 per cent.

Women and Home Lighting.

Successful Convention in London.

On Thursday and Friday last week, April 29th and 30th, London was the centre for ladies connected with various electrical undertakings, companies, and firms in various parts of the United Kingdom. By invitation of the Electric Lamp Manufacturers' Association they came from far and near—some from electricity showrooms, others from the showrooms of manufacturers, wholesalers and contractors, and yet others by invitation of the Electrical Association for Women, to attend the First Home Lighting Course for Women at the E.L.M.A. Lighting Service Bureau in Savoy Street.

The proceedings were divided each day into a morning and afternoon session, and under the chairmanship of Mr. W. E. Bush, the manager of the Bureau, and the experienced lecturing of members of E.L.M.A.'s expert staff, some sixty ladies were initiated into some of the problems of illumination. Such matters as lighting progress down the ages culminating in the modern electric lamp, the control of light, modern wiring systems, lighting fundamentals, light as a decorative medium, comparisons of good and bad lighting, selling light (showroom, window, and other demonstration), and the possibilities of better lighting in the home and the need for campaigning to secure it, were all parts of the theme. The "students" had excellent opportunities for asking questions which had arisen in the course of their own business occupations, and no doubt they are all back in their places this week far better equipped for rendering efficient electrical service, having at command many new talking points with which to persuade existing and potential consumers.

How well-conceived was the whole scheme will be recognised when we mention that the Bureau under-

took, through its staff, the reserving of hotel accommodation for such of the visiting students as required it for the period of their stay in London. How appreciative they all were of the efforts that had been made for their comfort and instruction, for the facilities that their employing undertakings, &c., had afforded them to be absent from their ordinary duties so as to attend the course, was amply demonstrated by the most excellent spirit which characterised an informal dinner which took place at the Florence Restaurant last Friday evening, as the concluding function in the programme.

Mr. C. W. Sully, Director of E.L.M.A., presided at the dinner. He proposed a toast including all kinds of guests who were present. The speeches were few and brief. Miss Holm returned thanks on behalf of the visitors from the provinces, and Mrs. Hollis on behalf of those from London and its suburbs, while Miss Haslett spoke appropriately concerning the work of the Electrical Association for Women. Mr. J. W. Beauchamp, Director of E.D.A., followed, and Mr. A. H. Bridge (ELECTRICAL REVIEW) responded for the Press.

The musical programme delighted the audience immensely, and it was obvious that the dinner formed a very popular means for winding up a thoroughly popular course; perhaps the most homely and human touch of all was the presentation of a box of chocolates to Miss Hodge, who had been so charming a Fairy Godmother to all the women during their stay.

"Students" at the E.L.M.A. Home Lighting Course for Women.

As the occasion was one of a quite exceptional character, and in order to indicate how representative it was, we give below the names of most of the "students"; a few others who attended were members of the Electrical Association for Women, but their names were not registered. We also reproduce a group photograph taken on the steps of the I.E.E. building during the course.

Miss M. de Gruchy, Croydon Electricity Department.
Miss M. F. McDonald, G.E.C., Birmingham.
Miss Veda Brice, Beckenham U.D.C. Electrical Department.
Mrs. V. K. Shepherd, member of Electrical Assn. for Women.
Miss A. Jackson, Lighting Service Bureau, Newcastle.
Miss K. S. Lindsey, Lighting Service Bureau, Glasgow.
Miss F. M. Ridley, G.E.C., Newcastle.
Miss R. F. Kennedy, Corp. Electricity Dept. Glasgow.
Miss Crane, Chingford Electricity Supply Co.
Miss Winterbottom, Metro-Vick Supplies, Ltd.
Miss U. O'Connor, J. W. Russel, Watford.
Miss F. Swire, Hackney Electric Supply Dept.
Mrs. Hollis, West Ham Electricity Dept.
Miss D. Bentley and Miss O. Bull, Stoke-on-Trent Electricity Dept.
Mrs. Poysons, Electricity Works, Epsom.
Miss H. W. Forbes, North Metropolitan Electric Power Supply Co., Enfield.
Miss C. Carter, Sevenoaks and District Electricity Co.
Miss I. Clements, Stoke Newington Borough Electricity Dept.
Miss M. Selbey, member Electrical Association for Women.
Mrs. E. A. Clement and Mrs. J. Tyler, South Wales Electric Power Co., Cardiff.
Miss G. C. Senior, G.E.C., Cardiff.
Mrs. Peel and Miss Lee, G.E.C., London.
Misses F. M. Upchurch and D. M. Geddes, North Metropolitan Electric Power Supply Co., Palmer's Green.
Miss Mioprio, North Metropolitan Electric Power Supply Co.
Miss O. Holt and Miss Green, Edison Swan Electric Co., London.
Miss J. Dent, J. C. White, Manchester.
Miss Davies, Wolverhampton Electricity Dept.
Miss Pedler, B.T.-H. Co., Birmingham.
Miss E. Kerswill and Miss R. Pecken, Bristol Corporation Electricity Department.
Miss A. A. Stemp, Cheltenham Corporation Electricity Dept.
Miss G. Busby, North Met. Electric Power Supply Co., Edmonton.
Miss E. Dickinson, Bermondsey Borough Council.
Miss F. M. Simpson, North Met. Electric Power Supply Co., Edgware.
Miss J. Clayton, North Met. Electric Power Supply Co., Tottenham.
Miss A. Holm, Newcastle Electricity Supply Co.
Mrs. Arnold and Miss M. Fox, City of Bradford Electricity Dept.
Miss J. Lees, Siemens & English Electric Lamp Co., Ltd., London.
Mrs. Cross, Westminster Electric Supply Corporation.
Miss Hansell, North Met. Electric Power Supply Co., St. Albans.
Miss J. P. Lewis, member of Electrical Assn. for Women.
Miss E. M. Sheret, North Met. Electric Power Supply Co., Wembley.
Miss A. B. Watson and Miss M. Greenhill, representatives of "Good Housekeeping."
Mrs. C. Taylor, representative of "E.D.A."
Mrs. O. Fletcher and Mrs. A. L. Walker, North Met. Electric Power Supply Co., Barnet.
Miss Haslett, director, Electrical Assn. for Women.
Miss B. Moss, Tottenham Light, Heat and Power Co.

Loud-speakers in Bath Abbey.—As in many other historical buildings in the United Kingdom, the acoustics of Bath Abbey are unfortunately bad. Services conducted from the pulpit and lectern are inaudible to half the congregation, and loud-speakers have accordingly been installed in order to overcome the various difficulties. A Marconiphone No. 1 "Public Address" equipment has been used for the purpose with a microphone on the pulpit and lectern and two loud-speakers suitably mounted in the organ loft. The amplifier and control outfit is housed in a cellar-like compartment leading to the transept, and comprises a charging board, amplifier, and a sub-control. From this point a microphone can be switched in and out of circuit as required. It was found that one of the loud-speakers required less volume than the other, and suitable damping apparatus was incorporated in order that proper acoustic balance should be maintained.

Electricity Supply in Great Britain.—XV.

North Wales.

THE counties of Anglesey, Carnarvon, Denbigh, Flint, Merioneth and Montgomery comprise the greater part of the area of the North Wales and South Cheshire Electricity District, as approved by Parliament.

The map of these six counties has not been reproduced, but copies of the map are available if required.

The 1921 Census gives the following particulars for these Administrative Counties:—

Administrative County.	Acres.	Persons.	Resident families.	Buildings not containing dwellings.
Anglesey ...	176,630	51,744	12,847	1,020
Carnarvon ...	366,005	130,975	31,537	2,446
Denbigh ...	426,080	154,842	33,975	2,472
Flint ...	163,707	106,617	23,002	1,914
Merioneth ...	422,372	45,087	10,758	1,238
Montgomery	510,110	51,263	12,064	1,092
Total ...	2,064,904	540,528	124,183	10,182

The number of kWh generated in Area No. 6 (which includes the output of the generating stations owned by the Chester and Crewe Corporations and those owned by companies at Aberystwyth and Oswestry, as well as the output of the generating stations in the above six counties) is given in Table 8 of the Electricity Commissioners' publication, "Generation of Electricity in Great Britain."

Year ending March 31st.	kWh generated. Area No. 6.
1922	38.990,369
1923	41,753,834
1924	52,407,347
1925	59,834,945

Table 8 also gives the following figures for kWh generated by water power:—

Year ending March 31st.	kWh generated by water power. Area No. 6.	Great Britain.*
1922 ...	27,035,496 ...	29,107,036
1923 ...	29,074,884 ...	31.823,031
1924 ...	40,704,029 ...	44,094,796
1925 ...	46,768,001 ...	51,093,237

*In Appendix I to the Weir Report, the available water power in Great Britain is estimated to be capable of giving an output of 2,120,000,000 kWh per annum.

The following is a list of the existing authorised undertakers:—

Local Authorities.

Abergele and Pensarn Urban District Council.
Bangor Corporation.
Bethesda Urban District Council.
Bettws-y-Coed Urban District Council.
Carnarvon Corporation.
Colwyn Bay Urban District Council.
Connah's Quay Urban District Council.
Conway Corporation.
Hawarden Rural District Council.
Holyhead Urban District Council.
Llandudno Urban District Council.
Llanfairfechan Urban District Council.
Llangollen Urban District Council.
Menai Bridge Urban District Council.
Mold Urban District Council.
Penmaenmawr Urban District Council.
Prestatyn Urban District Council.
Pwllheli Corporation.
Rhyl Urban District Council.
Wrexham Corporation.

Companies.

Llanrwst Electricity Supply Co., Ltd.
North Wales Power Co., Ltd.
North-Western Electricity and Power Gas Co.
Ruthin Electric Supply Co., Ltd.

Authorised Persons.

Assheton Smith, G.W.D., Esq., and Successors.

Applications for Special Orders under Section 26 of the Electricity (Supply) Act, 1919, have been lodged by the following:—

Wrexham Corporation (Extension).
Colwyn Bay Urban District Council (Extension).
Wrexham Rural District Council.
Portmadoc Urban District Council.
Gwynedd Trust, Ltd.
Executors of Mrs. M. A. Owen.

Further particulars of these applications are given in the Fifth Annual Report of the Electricity Commissioners and also in the Report of the North Wales and South Cheshire Joint Electricity Authority for the year ended March 31st, 1925.

In this connection it is stated (on page 12, paragraphs 35 and 36, of the Electricity Commissioners' Fifth Annual Report) that:—

"Since the coming into force of the District Order, the North Wales Power Company has pressed forward actively with the establishment of the transmission scheme, and the marked progress already made has not only resulted in the supersession of local generation at a number of centres owing to the availability of bulk supplies, but has also stimulated a number of applications for Special Orders for distribution powers in new areas capable of being developed by means of supplies from the transmission system."

"The practical results of the steps already taken to improve the organisation for the supply of electricity in this District provide an informative indication of the manner in which re-organisation and further development is accelerated as a consequence of the establishment of a comprehensive transmission system over a wide area."

Marine Life-Saving Services.—In April, 1923, the control of H.M. Coastguard passed from the Admiralty to the Board of Trade, the force being reconstituted primarily for life-saving duties, and in December, 1925, the Coastguard Act, 1925, was passed. The shore signal stations maintained by the Admiralty for Naval purposes and on behalf of Lloyd's (19 in number) participate in the life-saving organisation, the Board of Trade making an annual payment to the Admiralty in respect of such services.

Electrical communication naturally takes a prominent place in a life-saving organisation. Consequently, wherever possible, every coastguard station, look-out position, volunteer-in-charge and watchman-in-charge is connected to the exchange telephone system of the country. Certain lifeboat authorities are also provided with telephone facilities at the charge of the Board of Trade. In localities where the exchange system is not sufficiently developed, private circuits connecting two or more coastguard stations are provided with the necessary extensions to the look-out positions and lifeboat authorities in the neighbourhood. Provision of telephone facilities for life-saving purposes is also made to selected lighthouses and light-vessels, but in the case of lightvessels telephone cables are being gradually superseded by wireless telephony. Under this system a group of lightvessels are in communication by wireless telephone with a centrally situated coastguard station. In the United Kingdom wireless communication with vessels at sea, other than those of His Majesty's Navy, is conducted by a number of coast wireless stations under the control of the Postmaster-General. For each of these stations and also for each of the Admiralty wireless stations, there is a liaison coastguard station situated adjacent to, and in close telephonic touch with, the coast wireless station, to which the wireless station reports immediately any S.O.S. signal is received from a vessel within a certain defined area, including the British Isles. It is then the duty of the liaison coastguard station to plot the position given in the S.O.S. signal on a chart and then dispatch it to the officer of coastguard off whose district the vessel in distress is situated. This officer initiates the necessary steps for the dispatch of appropriate assistance, informing the liaison station of the action taken, which in turn passes on the information to the wireless station in order that the vessel in distress may be acquainted that assistance is forthcoming. Special priority is afforded by the Postmaster-General to all messages transmitted on life-saving service by telephone or telegraph.

The I.E.C. Meeting in America.—II.

A Cursory Account of the Proceedings.

By PHEIDIPPIDES.

The subjects dealt with at the Conference were as follows:—

Nomenclature.
Symbols.
Rules and Regulations for Transmission Lines.
Rating of Electrical Machinery.
Standard Pressures.
Transformer Oils.
Prime Movers, Steam Turbines.
Prime Movers, Hydraulic Turbines.
Traction Motors.
Terminal Markings.
Lamp Caps and Holders.

The opening technical session of the Conference, presided over by Signor Semenza, was occupied by the reading and discussion of papers by experts on different aspects of the question of machinery rating. The authors and titles were as follows:—

Dr. A. E. Kennelly:—"Can the Thermal Capacity of Electrical Machines be made a Simple and Practical Element of Rating?"

Prof. E. Morelli:—"The true meaning of Ambient Temperature, Limits of Temperature, and Temperature Rise."

Mr. Roger T. Smith.—"Ambient Temperature as a Testing Temperature of Reference, and as a Climatic Entity."

Papers were read by Mr. A. Huber Ruf and Dr. H. Behn-Eschenberg, Mr. C. Rodgers, Mr. Frans Dupont, Dr. M. Kloss, and Mr. R. Liljeblod, on the question: "What is the Importance of Overload Requirements, and what are the Main Reasons for the Same?"

The papers emphasised the fact that a motor was usually called on to give an average output plus an intermittent overload, and then discussed how this was looked after in different countries. The British practice is to limit the temperature rise for the average load to such a figure, 40 deg. C., that the usual over-loads are automatically cared for, while on the Continent the practice is to adopt a continuous maximum rating with a 50-deg. rise, known as the I.E.C. standard rating. With the latter system of rating there is obviously no demand for over-load. In this country all difficulty in the use of the two systems has been overcome by showing when desired both ratings on the name plate. As regards the question of ambient temperature of reference, the British delegation favoured the retention of a standard of reference. At the conclusion of a long and interesting discussion, it was decided to advise the Rating Committee that there was no general demand for an over-load on the I.E.C. 50 deg. C. continuous maximum rating. The British 40 deg. C. rating would, of course, remain the standard for Great Britain.

Transmission Line Difficulties in Morocco.—In a recent issue of the house organ of the Compagnie Francaise Thomson-Houston, of Paris, reference is made to the difficulties which have been experienced in Morocco in connection with the 60,000-V transmission line between Casablanca and Rabat, owing to the large number of storks in that country. These large birds quickly discovered that the masts provided a means of building more stable nests than was possible in trees and chimneys. Although the nests have not caused any difficulties in connection either with the transmission line or the masts, considerable trouble has been experienced with the insulators, which have been much soiled by the excreta of the birds, but the difficulty has been overcome by the provision of smooth surface shields on which the storks cannot get a footing and by the construction of stork-perches in the vicinity of the lines.

Chilean Trade and Development.

More Propaganda Needed.

Mr. W. F. Vaughan Scott (British Commercial Secretary at Santiago) has forwarded a report on the industrial and economic situation in Chile (dated September, 1925) to the Department of Overseas Trade.* In his introduction and general review of the situation, Mr. Vaughan Scott says that the British Empire was the principal supplier of goods to Chile during 1924, providing 26 per cent. of the total, as compared with 23 per cent. supplied by the United States; Germany's share was 13 per cent. As regarded Chilean exports, the United States was the principal customer, with 41 per cent., while Great Britain occupied second place with 34 per cent.

It is considered that Chile has awakened from the static *regimé* of ultra-conservatism of many generations, and this has brought into play new energies which, if left unhindered, spell great expansion in trade. Among the many enterprises which are in prospect are a number of hydro-electric developments of importance.

Trading Methods.

Mr. Vaughan Scott deals very fully with the trading conditions in Chile. He says that our manufacturers must recognise the fact that practically every civilised nation has to-day entered into competition and is manufacturing every conceivable class of goods, at the same time jealously protecting and fostering these new industries. The fact that these nations have attained such rapid industrial development in a very few years makes it necessary for us to exert every effort if we are to maintain our relative position in, say, 20 years' time. The traditional individualism of the British manufacturer, which in the past has often stood him in such good stead, is to-day a source of disadvantage, and there is still a great deal too much fear of the man on the other side of the road knowing what the man on this side is doing. Success can only be maintained by co-operation, and, generally speaking, by specialisation. The handicap of high prices which is so evident in the bulk of foreign markets, can be greatly lessened by efficient salesmanship and propaganda, and frequently can be overcome altogether by these means. United States manufacturers, in particular, have realised this, and though their propaganda costs them a great deal of money, they are reaping the benefit. It is time that our "Buy British goods" campaign was extended in appropriate form beyond Great Britain and the Dominions. British manufacturers already have abroad the finest network for distribution that any nation could desire. Trading conditions are also dealt with in a sub-report by Mr. S. H. Gudgeon (Vice-Consul at Iquique), who says that one effect of the keener competition of the last few years has been to bring the producer into closer touch with the consumer. To-day many manufacturers are represented by a travelling agent, or perhaps by a small firm which places its orders direct with its principals, on a purely commercial basis.

With regard to the investment of capital, Mr. Vaughan Scott says that American capital is eagerly welcomed in Chile, and fresh British capital would be equally welcomed. In the interests of our future trade in this country it is most important that our investments should be increased and not decreased, as is the present case. An important and growing market exists in Chile for mining equipment, including steam boilers and engines, gas engines, water turbines, electric motors, converters, and other machinery.

Copper Production.

During the year under review the copper mining industry satisfactorily progressed in spite of a shortage of water power, which reduced the output. Exports of bar copper during the years 1923 and 1924 and the first 10 months of 1925 were 162,419 tons, 181,442 tons and 130,362 tons respectively. Chile already ranks second, after the United States, as a copper-producing country, and during the next few years she will increase her production by a further 190,000,000 lb. per annum, as a result of the decision of the Anaconda Copper Co. to complete the installation of the Andes Copper Co.'s mine at Potrerillos. The Chile Exploration Co. (New York) at Chuquicamata, near Antofagasta, has continued to produce and export very pure copper in bars.

Railway Electrification.

Among the railway developments which are in hand is the electrification of the Transandine Railways. The locomotives for this system have been ordered from Switzerland, as it is stated that British and United States manufacturers have less experience in rack railway equipment. Power will be supplied by the Maitenes power station, belonging to the Compania Chilena de Electricidad, which supplies Santiago and the first section of the State Railway to Valparaiso. The completion of the electrification of the line from Santiago has resulted in greatly accelerated service for goods and passengers. The improvements being carried out are the installation of automatic brakes and couplings, a feeder line for electrical energy for lighting stations, improvements in signals and points, &c. The administration of the First Zone has drawn up a plan of improvements, and estimates the cost at £5,000,000, for which a loan will have to be raised.

*H.M. Stationery Office. 2s. 6d. net.

The Nitrate Railway Co., in order to counteract the accumulative deterioration of its property, submitted a scheme to the Government involving an expenditure of £1,250,000, which provided for the introduction of several general improvements, and in particular the electrification of the heavy-grade section. Owing, however, to the failure of the company to secure an extension of its concession, the electrification scheme was abandoned.

Radio Telephony and Telegraphy.

Radio-telephony continues to make progress in Chile, but the trade is still in the hands of foreign competitors, the bulk of it being done by United States manufacturers, followed by Germany. Probably all the business done by Great Britain only amounts to 10 per cent. The number of broadcasting receiving sets at present in use is about 45,000, as compared with 12,500 a year ago. During 1924 the only broadcasting station in operation was that of the Radio Chilena Corporation, but since then four large stations have been installed—three at Santiago and one at Concepçion. Beyond these there are nearly 24 stations erected by newspapers, business firms, and others. The first law dealing with broadcasting was passed in 1925. Under this decree the Republic is divided into seven zones, in each of which only two broadcasting stations of the first category may be installed, *i.e.*, with power of 1 kW or more, which must use wave-lengths between 350 and 425 metres or 475 and 545 metres. The wave-lengths of the stations situated in the same zone must have a minimum difference of 100 metres, and there must be a difference of 50 metres between contiguous zones. A radio transmission station cannot be installed at less than 28 km. from permanent Government stations. The Government has stations at Valparaiso, Talcahuano, Frutillar, Punta Arenas, and will shortly have one at Arica. The naval wireless station near Antofagasta, constructed under the supervision of Messrs. Marconi, was finished and opened in January, 1925. The station is in existence primarily for naval purposes, but commercial and ordinary messages can also be transmitted and received. The service, however, is apt to be dilatory, and so has proved of little value commercially.

Trade in Electrical Goods.

Mr. V. V. Cusden (Vice-Consul at Valparaiso) says that the market in that district for electrical apparatus and accessories is held principally by German and American firms, there being a comparatively small sale of British-made goods. This is probably partly accounted for by the fact that British goods are more expensive, being of a superior quality, and therefore not so attractive to the Chilean market. In the Concepçion, Coronel, and Lota district, according to Mr. E. Cooper (British Consul at Concepçion), practically all of the electrical goods are supplied by Germany.

General.

The large construction programme undertaken by the Compania de Electricidad de Valparaiso, after it acquired the properties about two years ago, has been practically completed; the company is giving a more efficient service and is able to extend the use of electricity. A number of factories have changed over their plants to the more economical electric power, and others will shortly do the same. As a consequence, the power consumption has doubled during the last year, the number of users has increased by about 2,000, and the total sale of energy by about 3,000,000 kWh. The tramway system at Valparaiso and suburbs is efficient, but it is not at present a paying concern. The new cars on the Viña del Mar route are giving excellent service, and are well patronised, but motor-'bus competition is very keen.

A proposal is on foot to hold an international industrial exhibition at Viña del Mar in September, 1927.

The revision of the import duties has remained in abeyance, but will probably be dealt with during the current year.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

Advertisement Correction.—We regret to find that in the advertisement of the WANDSWORTH ELECTRICAL MANUFACTURING CO., LTD., appearing in our issue of April 30th, a printers' error occurred in the type relating to one of the forms of switch made by the company—the last of all. For "*Imported* Quick-Make and Break," &c., read *Improved*.

The London Chamber of Commerce.—Among the matters dealt with in the Chamber's 44th annual report (1925), are electricity supply in the City, merchandise marks, national and local economy, rating and valuation, &c. With regard to the first subject, mention is made of the joint action taken by the Chamber and the City Corporation, as a result of which the charges for electricity were slightly reduced. The report states that the Committee appointed for the purpose will consider it its duty to carefully watch the working of the new London Electricity Acts. The "standard prices" are not necessarily permanent and, apart from the general financial result, attention will be directed to several other features of the Acts, for instance, that which permits the companies to charge different rates to large and small consumers.

In presenting the report, the Council says that, as was pointed out last year, new factories in the war zones are being equipped with the most up-to-date appliances, and it is essential that a forward policy in this matter should be followed by manufacturers here and that the trade unions should abandon their opposition to all things new.

Cable Contract.—MESSRS. W. F. DENNIS & CO. inform us that the telephone cable about to be laid between England and Holland (ELEC. REV., April 23rd, p. 664, note entitled "The Telephone Service"), was manufactured by Felten and Guilleaume Carlswerk A.G. at Coln-Mulheim.

Industrial Retrospect and Prospect.—The Federation of British Industries says that there was a moderate increase in trade during the past quarter which was widely diffused, *i.e.*, not confined to the major industries. This is said to be due to a seasonal improvement and to the effects of the coal subsidy. The price curves show that a period of readjustment was in progress and the same conditions prevailed in other countries. American observers report a feeling of uncertainty and a probable slackening of activity. In Germany a state of serious trade depression still persisted, a condition which was partly due to the need for some further relative downward adjustment of the German cost of living and wages in order to bring them more into line with those in other countries. All indications point to the confirmation of the Federation's forecast that the current year was likely to be one of readjustment and consolidation rather than expansion.

Unemployment.—The total of registered unemployed fell to below a million during the week ended April 19th. The actual figure was 996,600, as compared with 1,024,389 on April 12th, and 1,202,670 on April 20th, 1928.

Municipal Trading at Sydney.—At a meeting in March, at which the Sydney City Council reaffirmed its intention of commencing the sale of electrical appliances, the acting general manager of the Electricity Department (Mr. Maling) said that he had received a demand from the Electrical Traders' Association, of which the Council was a member, for £15 15s. subscription and levy. In view of the fact that the Association is strenuously opposing the Council's trading proposals, it was decided to pay the amount demanded and withdraw from the Association.

Modified Mexican Import Duties.—The *Board of Trade Journal* for April 29th contained a list of articles which, by a recent Presidential Decree, are to be subject to modified duties upon importation into Mexico. Among these are electric stoves and heaters of all kinds. The new duties upon these are:—Weighing more than 20 kg. net each, 0.15 peso per kg.; weighing up to 20 kg. each, 0.30 peso per kg.

A Contractor's Hire-purchase System.—During the hearing of evidence by Parliamentary Committees upon clauses giving municipal supply authorities powers to wire houses and sell appliances by hire-purchase systems, a great deal has been said regarding the inability or unwillingness of contractors to do work by this method. Some contractors, on the other hand, have expressed their willingness to wire houses upon the deferred-payment plan, and a concrete case of the kind came under our notice when Mr. Harry Moss sent us the card which is reproduced herewith. We think the card is self-explanatory, but it will be noticed that it does not get over the difficulty of persuading those who are mere tenants to have their houses wired.

To Owner Occupiers
YOU CAN HAVE YOUR HOUSE FITTED WITH
ELECTRIC LIGHT
ON MY EASY PAYMENT SYSTEM.
£1 DOWN AND 1/- PER LIGHT PER WEEK TILL PAID FOR
PHONE, WRITE or CALL
HARRY MOSS, Registered Electrical Contractor, A.M.I.E.E.
82, LEEDS ROAD, BRADFORD.

A Contractor's Hire-Purchase System.

Municipal Trading.—At the annual meeting of the Association of British Chambers of Commerce on April 22nd and 23rd, a resolution was passed strongly protesting against powers being granted to municipal authorities to trade in commodities in competition with ratepayers.

New Businesses Registered.—The following businesses have recently been registered under the Business Names Act:—

B. C. Palmer & Co. (electrical engineers), Cromwell House, High Holborn, W.C.

Victor Engineering & Supply Co. (electrical engineering), 118, Oxford Road, All Saints', Manchester.

"Isca" Electrical Engineering Co. (general electrical contracting and sales), 177, Sidwell Street, Exeter.

Eastern Wireless Co. (manufacturers of radio sets and accessories), 90, Three Colt Street, E.14.

James V. Coonan Co. (consulting mechanical and electrical and structural engineers), 8-9, Northwalls, Queen's Dock, Hull.

C. W. H. Electrical Co. (electrical, wireless, and general engineers), 53a, Standishgate, Wigan.

Peach, Martin & Co. (dealers in radio components and sets), 11, Carysfort Road, Stoke Newington, N.16.

Stockport Battery Service (accumulator makers and factors), Wellington Grove, Stockport.

Ludgate Radio Co. (dealers in radio and electrical goods), 56, Ludgate Hill, E.C.4.

Engineering Employés' Wages.—A conference of delegates of trade unions in the engineering industry was held in London on April 29th, when it was decided to recommend the members of the unions to vote in favour of a strike as a means of enforcing the demand for increased wages. It was also decided to approach the executive councils of unions with members engaged in power stations and other public utility undertakings to decide what action should be taken. A joint committee was instructed to set up a strike organisation, as it was considered certain that the ballot would result in a majority in favour of a stoppage of work.

Key Industry Duties.—As we briefly stated last week, carbons and scientific instruments are affected by the alterations proposed in the Key Industry Duties. The existing *ad valorem* duty on arc lamp carbons is to be replaced by a flat rate of 1s. per lb., while amorphous carbon electrodes are added to the list of protected goods with a duty of 33⅓ per cent. *ad valorem*. Galvanometers, electroscopes, gauges and measuring instruments of precision of the types used in engineering shops and viewing rooms, whether used in such or not, together with certain other instruments and their component parts, are still to be subject to a duty of 33⅓ per cent. *ad valorem*.

The duties are to remain in force until August 19th, 1936.

These regulations have been made as a result of the recommendations of the Board of Trade Committee, under the chairmanship of Sir Burton Chadwick, which was appointed to consider the matter.

Halifax Corporation and Contractors.—The Corporation Electricity Committee recommends that, as from May 1st, sales to customers of over £1 shall be invoiced, wherever possible, to the customer's electrical contractor, so that the contractor may be allowed the usual trade discount, provided that the Corporation retains a profit of not less than 10 per cent. If the customer has no contractor, or the contractor fails to send the order accompanied by cash, if cash is asked for, the sale will be direct to the customer at retail list price without deduction. In view of the above concession to contractors, the Committee says that it is unable to comply with a request for reduced rates for electricity used by contractors for demonstrative purposes, especially as the Corporation showrooms are available for demonstrations.

Trade Announcements.—The SCOTT INSULATED WIRE CO., LTD., has secured larger premises at 44, Queensland Road, Holloway, London, N.7 Telephone No.: "North 1706." All correspondence for the works should be addressed there. The head office remains at 69, Fleet Street, E.C.4, for the present.

MR. CLAUDE G. NAPP has acquired the business of the Wireless Instruments Co., of Harpur Street, Bedford.

After May 17th the address of MR. T. A. NUNWICH, representative of the Midland Electric Manufacturing Co., Ltd., for Lancashire will be 21, Clinning Road, Birkdale, Southport.

Catalogues and Lists.—THE METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester.—Special Publication 7200/6 containing particulars of the company's fabrics, papers, mica, bakelite, fibre and other insulating materials.

MESSRS. JOSHUA JONES & CO., LTD., 76, Worship Street, Finsbury, E.C.2.—A list of charges for varnishing paper.

THE I.L.G. ELECTRIC VENTILATING CO., 2850, N. Crawford Avenue, Chicago, Ill.—A booklet and leaflets advertising the company's electric fans and heaters.

THE ELECTRIC CONSTRUCTION CO., LTD., Ingersoll House, 9, Kingsway, W.C.2.—A brochure entitled "Modern Electrical Plant," containing over 60 pages of illustrations of the company's products, as well as data relating to cables, mechanical power transmission, &c.

MR. W. H. PETTIFOR, 11, Victoria Street, S.W.1.—A price list of electrical aids for the deaf, with pamphlets illustrating and describing various microphonic appliances.

THE STEAM FITTINGS CO., LTD., West Drayton, Middlesex.—An illustrated and priced pamphlet dealing with the company's dial thermometers.

THE BEKO LAMP CO., 5, Pocock Street, Blackfriars, S.E.1.—A price list of electric lamps.

MESSRS. T. HARDING CHURTON & CO., LTD., Atlas Works, Leeds.—Price lists of 25-cycle, three-phase induction motors, including special crane patterns.

MESSRS. BAXENDALE & CO., LTD., Miller Street, Manchester.—A pocket catalogue of conduits and fittings, fuse boards, lampholders, switches, cables, and other electrical accessories and tools. Illustrated and priced.

THE RELAY AUTOMATIC TELEPHONE CO., LTD., Marconi House, Strand, W.C.—The "Relay Recorder" for May, advertising the company's automatic telephone system.

THE WESTMINSTER ELECTRICAL CO., 2, Tanswell Street, Lambeth, S.E.1.—A trade price list of electrical and radio materials and fittings.

MESSRS. J. J. EASTICK & SONS, Eelex House, 118, Bunhill Row, E.C.1.—An illustrated and priced pamphlet of radio apparatus.

Bankruptcy Proceedings.—CHARLES HUBBARD, 13, Magdalen Street, Norwich, electrician and wireless dealer.—The first meeting of creditors was held on April 23rd at the Official Receiver's Office, Norwich. The statement of affairs showed gross liabilities of £514, of which £472 was expected to rank against assets of £677, leaving a surplus of £205. Debtor did not admit that he was insolvent. It appeared that he commenced business on his own account in October, 1923, with about £300, his savings and stock which he had created in his spare time. The matter was left in the hands of the Official Receiver as trustee of the estate. The following are creditors:

	£		£
Bankers	105	Newbold & Co.	21
Hirst Bros. & Co., Ltd. ...	33	Siemens Bros. & Co., Ltd. ...	29
Houghtons, Ltd.	65	Stamp, S.	20

PETER JENNINGS, commercial traveller, Bury Road, Breightmet.—This debtor appeared at Bolton Bankruptcy Court on April 21st to undergo his first examination. His deficiency was £266. It was stated that since 1921 he had been employed as traveller for a firm specialising in electrical fittings and wireless goods. In 1924 he went to Ireland on behalf of a firm, and whilst there he was sent wireless goods of the value of £1,000. On leaving the service of the firm he was sued for an alleged deficiency of £35 in stock. Judgment was given against him, and with costs he had to pay £53. Debtor attributed failure to heavy business and domestic expenses. The examination was closed.

GASTON O. BONNET-PIERROT, electrical contractor and engineer, 2a, Camden Road, N.W.—This debtor attended before Mr. Registrar Mellor at the London Bankruptcy Court last week, in custody, for public examination upon accounts showing liabilities of £2,796 and assets of £5, apart from bad book debts, £485. Questioned by the Official Receiver, debtor said he commenced business in February, 1923, with a capital of £200, and a year later he began to deal in radio accessories, but owing to trade depression the business was not successful. In January last he was sentenced at the London Sessions to 15 months' imprisonment for obtaining wireless headphones with intent to defraud. The examination was concluded. The following are the principal creditors (unsecured):—

	£		£
Lee, Albert, & Co. (1923), Ltd.	278	Brown, S. G., Ltd	350
Stokes, C.	170	Fellows Magneto, Ltd.	80
Renaults, Ltd.	145	Brown Bros., Ltd.	36
Stevens, A. J., & Co. (1914), Ltd.	729	Bransome, Kent & Co., Ltd. ...	42
Burndept, Ltd.	130	Electrical Supplies, Ltd.	20
Clarke, N., & Co., Ltd.	168	Hunt, A. H., Ltd.	93
Formo Co., Ltd.	179	Edison Swan Electric Co., Ltd.	104
Metropolitan-Vickers Electrical Co., Ltd.	39	Radio Instruments, Ltd. ...	21
Coleman Bros. & Stone, Ltd. ...	45	Dew, A. J., & Co., Ltd. ...	50
		North Met. E.P.S. Co.	20

D. E. DAVIES, wireless engineer, 19, Poulton Street, Kirkham.—Receiving order made April 27th on debtor's own petition.

F. V. LAMBERT (Lambert & Curley), electrical contractor, 27, Parrock Street, Gravesend.—Receiving order made April 26th on debtor's own petition. First meeting, May 7th, at the Official Receiver's office, 280a, High Street, Rochester. Public examination, May 10th, at the County Court House, Rochester.

G. TURNER (Radio Supply Co.), electrician and wireless dealer, 34, Mesnes Street, Wigan.—Receiving order made April 27th on debtor's own petition.

W. G. HEAD, electrical engineer, late of 30a, High Street, Ashford.—Trustee, Mr. A. H. Ward, Official Receiver, 10, Burgate Street, Canterbury, released April 23rd.

A. WOOD, electrical agent, 67, Bradford Avenue, Cleethorpes.—Trustee, Mr J. F. Wintringham, Official Receiver, St. Mary's Chambers, Great Grimsby, released April 23rd.

J. A. REFOY (Varley Radio Co.), dealer in wireless apparatus, 178, Ancona Road, Plumstead, S.E.—First and final dividend of 5½d. in the £, payable May 17th at the Official Receiver's office, 29, Russell Square, W.C.

F. F. GREGORY, electrical engineer, 2a, Westbourne Road, Luton.—Receiving order made April 24th, on debtor's own petition.

J. A. TREND, electrician, 31, Chapel Street, Luton.—Receiving order made April 24th, on debtor's own petition.

J. REGG and F. STEAD (Regg & Stead), radio engineers, 17, Old Chapel Street, Blackburn.—Last day for proofs for dividend, May 11th. Trustee, Mr. H. Parker, Official Receiver, 11, Winckley Square, Preston.

Company Liquidations.—H. E. DAVIS, LTD., 4, South Street, E.C., wireless and electrical manufacturers and agents.—Winding up voluntarily. Liquidator, Mr. R. S. Yates, Abbey House, 2, Victoria Street, S.W.1. A meeting of creditors was held on April 29th, at the Institute of Chartered Accountants, E.C., when the chair was occupied by the liquidator. A statement of affairs was presented which disclosed liabilities of £3,718, all due to unsecured creditors. There were debentures for £2,000, and it was stated that there was a further claim for £1,020 in respect of which an action was pending and against which the company was counterclaiming for a greater sum by way of damages. The liquidator said that the action was in respect of a number of dry batteries which had become unsaleable. The net assets were valued at £2,614, but from that amount had to be deducted £2,000 due to the debenture holder, which left £614, or a deficiency of £3,104. The company held £500 in debentures and £300 in shares in another company. The goodwill was put at £585. Those items had been shown on the statement of affairs, but were considered of no value. The company was incorporated in November, 1924, to take over as a going concern the business of electrical engineers which had been carried on by Mr. H. E. Davis. The consideration was £3,000 to be satisfied by £1,000 worth of shares and £2,000 worth of debentures. The liquidator said that the debenture holder had appointed Mr. William Osborne, of Balfour House, Finsbury Pavement, E.C., as receiver, and he was at the present time in possession of the whole of the assets. Mr. Yates said that he had seen the receiver and had obtained from him an undertaking that in realising the assets he would have due regard to the creditors' rights in the matter. He said that from the time of the incorporation there had been a loss on trading of £1,853. There was a petition on the file for compulsory liquidation. Mr. Baker (Wholesale Traders' Association) said that he considered that Mr. Davis, the debenture holder, should come forward and make the creditors some offer of composition. The meeting was then adjourned for that purpose. The following are creditors :—

	£		£
Igranic Electric Co., Ltd. ...	39	Hirst Bros. & Co., Ltd.	76
Discamusements, Ltd.	472	Duiker, J.	38
Wireless Components Co. ...	52	S.D.H. Manufacturing Co. ...	43
Rothermel Radio Corporation, Ltd.	132	Phillips Lamp Co., Ltd.	41
Crypto Electrical Co., Ltd. ...	44	Empire Electric Co.	32
Scott Insulated Wire Co. ...	30	Beaver Electric Co.	196
Trelleborge Ebonite Works, Ltd.	13	Redfern & Co.	41
Hardwareman and Builders' Merchant	33	Albert Lee & Co.	256
Autoveyors, Ltd.	46	Marcure, —.	32
Acme Show Card Co.	80	Burton, F. & H.	48
Lee & Churchill	53	Radio Equipment Co.	40
Hurley Machine Co.	65	Radi-arc Electric Co., Ltd. ...	37
Spiller, S. H.	98	Bretwood, Ltd.	106
Collinson Precision Co.	40	Buckinson Manufacturing Co. ...	54
Burndept, Ltd.	118	Cochrane & Cripwell	200
		Bankers	208

R. MCKELLEN & CO., LTD., wireless, &c., dealers, 58, High Street, W.C.—The first meetings of the creditors and shareholders were held on April 23rd, at Carey Street, a compulsory winding up order having been made on March 30th. The Official Receiver reported that the company was registered as a private company on May 7th, 1925, with a nominal capital of £10,000, to carry on a business which had previously been conducted by R. McKellen. The liabilities were said to amount to about £7,200, of which nearly £7,000 was owing to a Mr. Matthews. The assets comprised cash £15, stock, fittings and furniture £200, and book debts payable by instalments, £7,000. A difference of opinion arose regarding the appointment of a liquidator and it was intimated that the matter would be referred to the Court.

DUBLIN AND LUCAN ELECTRIC RAILWAY CO.—Mr. David McDowall Grosart, Conyngham Road, Dublin, has been appointed by Mr. Justice Johnston to be Official Liquidator of the company.

REFLEX RADIO CO., LTD.—A petition for the winding up of this company has been presented to the High Court by Watson Jones, Ltd., electrical and wireless factors, 235a, Blackfriars Road, S.E., and will be heard in London on May 11th.

FULLER'S UNITED ELECTRIC WORKS, LTD.—A petition for the winding up of this company has been presented to the High Court by Mr. R. H. Symonds, iron and steel merchant, of Albany Buildings, 39, Victoria Street, S.W., creditor, and will be heard in London on May 11th.

WESTERN ANGLO-SWEDISH ELECTRIC WELDING CO., LTD.—A meeting of creditors was called for May 1st at 24, Wood Wharf, Greenwich. Liquidator, Mr. W. N. Tomkinson.

MORGAN & TAYLOR'S RADIO ELECTRIC CO., LTD.—A meeting of members is called for May 31st at 31, Queen Street, Cardiff, to hear an account of the winding up from the liquidator, Mr. S. E. Clutterbuck.

BRITISH ELECTRIC VEHICLES, LTD.—Winding up order made by the High Court on April 27th.

BURY ELECTRICAL PLANT CO., LTD.—A meeting of members is called for May 28th at the offices of Messrs. C. R. Scholes and Co., Silver Street Chambers, Bury, to hear an account of the winding up from the Liquidator, Mr. T. S. Smith.

CHASE ELECTRICAL MFG. CO., LTD.—A meeting of members is called for May 28th, at the offices of Messrs. Corfield and Cripwell, Balfour House, Finsbury Pavement, E.C., to hear an account of the winding up from the Liquidator, Mr. W. A. J. Osborne.

Dissolutions of Partnership.—PRATT & Co., electrical engineers and magneto specialists, 26, Little Clarendon Street, Oxford.—Messrs. H. B. Pratt and A. E. Malins have dissolved partnership so far as concerns Mr. H. B. Pratt.

FARROWOOD ACCUMULATOR CO., electrical and radio engineers, 69, Mumps, Oldham.—Mr. C. H. Wood and Mr. J. C. Farrow have dissolved partnership. Mr. Wood will attend to debts.

ELECTRIC REGULATOR & HEATING CO., manufacturing electrical engineers, Mikado Works, 8, Whittall Street, Birmingham.—Mr. J. E. Horsburgh and Mr. R. Roberts have dissolved partnership.

WORSTER & HOUNSLOW, electrical and wireless engineers, 40, Lowlands Road, Harrow, and 12, Albany Street, N.W.—Mr. A. E. Hounslow and Mr. G. H. Worster have dissolved partnership. Mr. Worster will attend to debts and continue the business.

ROYAL ACCUMULATOR CO., electrical accumulator manufacturers, 18, Atkinson Street, Deansgate, Manchester.—Mr. W. E. Beardsall and Mr. W. Johnson have dissolved partnership.

Copper and Lead Prices.—Messrs. F. Smith & Co. report May 4th :—Copper (electrolytic) bars, £65, 10s. decrease; do. do. sheets, no change; do. do. wire rods, £75, 10s. decrease; do. do. h.c. wire, 9 7/16d., 1/16d. decrease.

Messrs. James & Shakespeare report May 4th :—Copper bars (best selected), sheet and rod, no change; English pig lead, £29 15s., 10s. decrease.

Messrs. Edward Till & Co. report May 4th :—India-rubber, Para fine, 2s., 1d. increase.

New Italian Companies.—Among the concerns recently organised in connection with the Italian electrical engineering industry are the Società F.A.U.S.T., Fabbrica Apparechi Utilita Speciali Termoelettrica, Milan, capital 30,000 lire; La Società Elettrotermica, Milan, capital 50,000 lire; and La Società Costruzioni Elettriche Telefoniche, Milan, capital 50,000 lire.

Chinese Notes.—The *Chinese Economic Bulletin* says that the Ta Yu Li Electric Light Co., Hangchow, has become one of the most prosperous industrial concerns in the Chekiang Province, and its growth has been accompanied by the establishment of about a dozen companies to supply fittings, &c. These companies have organised an association to fix prices and prevent unfair competition, and they supply goods to a number of neighbouring districts.

The Industrial Commissioner of Kiangsu is taking steps to establish connections between the Nanking Electric Light Co. and the Pukow Electric Power Co.

Through telephone communication was established in January between the Shanghai Chinese City and the foreign settlements.

It is reported that tests of the new radio station at Paotow, for communication with Peking, have been quite successful.

Hostilities in the district have held up the installation of the telephone system between Tientsin and Shanghai, a contract for which was secured by a French firm last year.

Local Exhibitions.—MORECAMBE.—In connection with the extensive exhibition promoted by the Morecambe Chamber of Trade which closed on April 28th, a big display was organised by Mr. J. Boyce, the borough electrical engineer. During the progress of the exhibition, lectures, demonstrations and kinema films all appertaining to the use of electricity in the home were given. A notable feature of the exhibition was that it was a traders' exhibition and a large portion of the space was taken up by the Corporation electricity and gas departments, which work quite amicably together, and, as far as possible, act in unison in carrying out extensions and distribution work. The supply system has recently been changed over to a.c., 3-phase, and new reduced rates were instituted on April 1st. Over 2,000 consumers have been connected since the introduction of the new supply, most of whom have taken up the rateable value scale—20 per cent. rateable value plus 1d. per kWh. In organising the display Mr. Boyce had the assistance of several well-known firms.

DEWSBURY.—A British and Empire Goods Shopping Week commenced at Dewsbury on May 1st. The Corporation Electricity Department established a temporary showroom for the week in the Market Place, making an attractive display of British-made electrical appliances for domestic cooking, heating, washing, &c.

New Australian Companies.—Electric Home Lighting, Ltd., has been formed in Sydney with a capital of £10,000, to carry on an existing business of manufacturers and vendors of power plant, electrical appliances, and machinery.

The State Electric Lighting, Ltd., was recently registered in Sydney, with a capital of £25,000, to carry on the business indicated by its title.

United States Electrical Exports.—*Commerce Reports* states that exports of electrical goods from the United States during February last were valued at $6,862,910, an increase of $1,862,597 over the February, 1925, total, but a decline of about $280,000 as compared with the January figure. Upon the whole, there was an increase in the shipments of generating equipment, the most notable rise occurring in the case of a.c. generators of 2,000 kVA or over. There was a decrease in the exports of d.c. generators owing to a heavy decline in the smaller sizes. There was an increase in the transmission and distribution apparatus class and in motors, except for a slight decrease in the case of railway motors. Other

classes which recorded increases were radio apparatus, domestic appliances, batteries, fans, and wiring accessories. On the other hand, insulated copper wire and cable exports showed a decrease.

Book Notices.—Two recently revised publications of "Technical Pamphlets for Workmen," issued by the Post Office Engineering Department, "Telephone Testing Equipment" and "Automatic Telephony: Step by Step Systems," are on sale at H.M. Stationery Office, price 6d. each net.

The Macintosh Cable Co., Ltd., has sent us an instructional book which it has issued for the assistance of wiremen when employed on the Macintosh surface-wiring system. It is fully illustrated and contains notes of a practical nature which should prove of value to the wireman. A feature is a cloth sheet of wiring diagrams. A cloth cover of suitable dimensions will allow rough pocket usage. The company has also issued a brochure describing the wiring system.

"The Annual Report and Accounts of the British Legion, 1925." (103 pp.). London: The British Legion.—This report records the continuance of the good work carried out by the organisation for ex-Servicemen for a number of years, and shows that there is still ample scope for its benevolent and social activities.

"Signal Wiring," by T. Croft. Pp. xii + 349; 463 figs. Price 15s.; "Introductory Electrodynamics for Engineers," by E. Bennett and H. M. Crothers. Pp. ix + 665; figs. 306. Price, 22s. 6d. London: McGraw-Hill Publishing Co., Ltd.

"Dictionary of Costing," by R. J. H. Ryall. Pp. xi + 377. London: Sir Isaac Pitman & Son, Ltd. Price 10s. 6d. net.

"Science Abstracts (A and B)." Vol. XXXIX. Part 4. April 25th, 1926. London: E. and F. N. Spon, Ltd. Price 3s. each.

Handbook Series of the U.S.A. Bureau of Standards, No. 6, "Safety Rules for the Installation and Maintenance of Electrical Supply Stations." Price 10 cents.—The contents of this publication comprise Part I and the "grounding" rules of the 4th edition of the "National Electrical Safety Code." The American protection recommendations for all classes of electrical machinery and apparatus used on supply undertakings are given.

Germany's Foreign Electrical Trade.—An American Trade Commissioner at Berlin informs *Commerce Reports* that important German electrical manufacturers report an increase of 30 per cent. in orders on hand at January 1st, 1926, as compared with a year ago, and admit an increase in workers of 150 per cent. during 1925 as compared with 1924. All large companies paid 6 per cent. or 7 per cent. dividends, and undoubtedly placed considerable earnings to reserves. The tonnage of imports increased 270 per cent., and the value at practically the same rate. A comparison of the import and export figures shows that Germany shipped 19½ times as many tons of electrical equipment as it imported, and that the equipment exported was 16 times as valuable as the equipment imported.

For Sale.—The Chief Superintendent, Southern Railway, invites offers for surplus machinery, including fans, lathe, oil separator, &c. (See our advertisement pages to-day.)

The Institute of Patentees.—The address of the Institute of Patentees (Inc.) has been changed to 39, Victoria Street, London, S.W.1.

Lighting and Power Notes.

Argentina.—HYDRO-ELECTRIC DEVELOPMENT.—A new hydro-electric station is to be erected at Andalgala, in the Province of Catamarca, to supply electricity to the government-operated mines and smelter and for domestic and industrial use.—*Reuter's Trade Service* (Catamarca)

The extensions at the Sorrento power station of the Société d'Electricité de Rosario have now been practically completed. The new plant comprises four boilers and a 15,000-kW turbo generator. During the past year the sales of electricity increased from 37,636,131 to 39,243,905 kWh.

Bury (Lancs.).—ELECTRICITY CHARGES.—The Corporation Electricity Committee has fixed the following charges for electricity:—Domestic tariff: 14 per cent., on the rateable value, plus 1½d. per kWh for the first 200 kWh per annum, and ¾d. for the remainder, with a minimum standing charge of 30s. per annum and a maximum standing charge of £4 5s. House lighting: 4½d. per kWh. Heating: 1d. per kWh. Shop lighting: 5d. per kWh. Shops with occupied houses, first 200 kWh, 4½d. per kWh, beyond, 5d.

Blagdon.—ELECTRICITY SUPPLY.—At a recent meeting of residents a resolution in favour of the introduction of electric light was adopted. The North Somerset Electric Supply Co., will erect h.p. mains through the centre of the village and supply a ¾-mile radius. The price to be charged is 9d. per kWh.

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—During the next eight months approximately $2,000,000 will be expended by the Winnipeg Electric Railway Co. and its subsidiaries in making the necessary provision to obtain and utilise additional power from the hydro-electric plant at Great Falls. In connection with the development at Grand Falls, tenders are now being prepared and contracts will shortly be awarded.

One of the principal proposals in the Ontario Government estimates is an item for $3,000,000 for the construction of a 110,000-V transmission line through the eastern district.

It is stated that the Shawinigan Water and Power Co. group and the Aluminium Corporation of America interests have purchased from the Duke and Price estates respectively their interests in the Duke-Price Power Co. This company installed plant at Maligne, on the Saguenay River, and brought into operation 360,000 h.p. last year. An extension to 480,000 h.p. is proceeding, and is expected to be completed shortly. The Aluminium Corporation of America at Caron Chute has plans for an ultimate development of 800,000 h.p.

Continental.—ITALY.—The estimated electrical energy available at the end of 1925 was 3,200,000 h.p., being more than double that of pre-war years and an increase of 300,000 h.p. for each of the past two years.—*Reuter's Trade Service* (Milan).

SICILY.—In a recent issue of *Energia Elettrica*, details are given of the hydro-electric plant which has lately been completed in Sicily to utilise the water power of the River Belice. About 7½ miles from Palermo, at a height above sea level of nearly 2,000 ft., a dam 128 ft. high and 850 ft. in length has been constructed to form an artificial lake with a storage capacity of 16,720 million gallons. From the lake, the water is led along a 7½-mile canal to an 11-million gallon storage reservoir. From this the water is conveyed to the generating station by means of a pipe 265 ft. in length. The water reaches the power station under a head of 1,550 ft. The plant comprises four Riva-Monneret turbines, each developing 3,500 h.p. at 750 r.p.m., these being coupled to 10,500-V alternators. The output is expected to amount to 25 million kWh per annum.

BELGIUM.—Work has recently been commenced by the Société d'Electricité de la Région de Malmedy on the erection of three hydro-electric stations to utilise the water power of the River Warchi.

FRANCE.—Work is well in hand on the construction of a new central power station which will have a capacity of 28,000 h.p. at Monistrol d'Allier for the Compagnie Electrique de la Loire et du Centre. The plant is expected to be ready for operation before the end of the current year.

BULGARIA.—Although it is estimated that water power to the extent of over one million h.p. is available in Bulgaria, very few hydro-electric plants have so far been erected in the country. The most important plants at present in course of construction are those on the Rivers Rila and Kritschin. The Rila installation will comprise three power stations at Rila, Pastra and Ilina. So far the only station to be completed is that at Pastra, where eight 3,300-h.p. turbo generators have been installed. The energy is stepped up to 35,000 V for transmission to Rila, Crerka, Pernik and Batanova.

Coventry.—LOAN.—The Corporation is making application for sanction to a loan of £14,321 in connection with the supply of electricity to the Radford housing estate.

Deal and Walmer.—ELECTRICITY SUPPLY.—The local authorities have been informed that in order to meet with the demand for a supply of electricity in the two towns, the South-East Kent Electric Power Co., Ltd., is arranging with Messrs. Pearson & Dorman Long, Ltd., for a bulk supply from Betteshanger Colliery, and it is proposed that electricity shall be transmitted by means of overhead cables to sub-stations, from which it will be distributed by underground cables in Deal and Walmer.

Eastbourne. — LOAN SANCTIONED. — The Electricity Committee has received sanction to a loan of £16,000 for mains and services.

Glasgow.—PROGRESS DURING MARCH.—The Corporation electricity manager reports that during March 159 houses were wired bringing the total to date to 2,122. There were 164 applications for hire of appliances, making the total since the scheme commenced 10,281. He has suggested that arrangements might be made for occupiers of small houses to pay the cost of the more expensive domestic appliances by monthly instalments, and the Sub-Committee on Propaganda has recommended that the proposal be adopted.

Hitchin.—ELECTRICITY SUPPLY.—The Rural District Council has decided to raise no objection to the Stevenage Electric Light and Power Co., Ltd., extending the mains to supply Council houses at Knebworth and Mile End. The company will provide services and fittings for two lighting points per house at 1s. per week if all the tenants are prepared to take a supply, three points at 1s. 6d. per week, and any additional point at 2d. each per week, plus the charge for electricity consumed.

Huddersfield.—LOANS.—The Electricity Committee has decided to apply for sanction to borrow £10,000 for transformers and £20,000 for mains.

Ilford.—ELECTRICITY IN BULK.—The Electricity Committee has approved the draft provisional agreement between the County of London Electric Supply Co., Ltd., and the Council regarding the proposed bulk supply of electricity by the Company to the Council.

LOAN SANCTIONED.—The Committee has received sanction to the borrowing of £5,000 for domestic apparatus to be let on hire.

SUB-STATIONS.—The Committee has recommended that three sub-stations be converted into automatic sub-stations and tenders for the necessary apparatus are to be obtained.

India.—RANGOON (BURMA).—Owing to the increased demand for electricity. the Rangoon Electric Tramway and Supply Co., Ltd., has recently installed additional plant. A 3,000-kW set has been erected and a new 6,600-V switchboard has been completed. Two 500-kW rotary converters have been installed in Turtle Tanks sub-station to take the tramway load in the east part of the city, and a considerable portion of the h.p. transmission system in the city and the suburbs has been changed over from 2,300 V to 6,600 V.

ELECTRICAL DEVELOPMENT.—Messrs. Martin & Co., of Calcutta, are promoting two new electrical enterprises, known as the Jubbulpore Electric Supply Co. and the Muttra Electric Supply Co., for the purpose of supplying electrical energy to the cities of Jubbulpore and Muttra respectively. Arrangements have been made with the military authorities, municipalities, and the railway companies at these places for the supply of electricity. The plant required for the Jubbulpore company consists of two 175-kW and one 300-kW alternators, with switchgear, &c., 7½ miles of h.p. feeders, and 15 miles of distributing mains, with street lighting, at a cost of Rs. 7 lacs. Additional plant will be also provided in the second and third year. For the Muttra Electric Supply Co. the initial plant consists of two 175-kW and one 50-kW alternators, with accessories, three miles of h.p. feeders, and 10 miles of distributing cables, with street lighting, &c., at a cost of about Rs. 5 lacs.

The Government of Madras states that hydro-electric schemes to be undertaken during the next five years are as follows:—(1) The Pykara scheme, with a capacity of 37,200 kW, which may ultimately be connected with the Moyar scheme, which will yield another 10,500 kW. (2) The Pinjikavi scheme, with a Kumbar connection, to develop about 18,000 kW. (3) The Papanasam scheme to develop about 21,000 kW. The estimated cost for the Pykara Fall development, which is expected to be completed in 2½ years, is Rs. 238 lacs.

Leek.—INAUGURATION OF EXTENSIONS.—Plant extensions, including a 400-kW gas-driven generating set, were formally inaugurated at the Urban District Council's electricity works on April 28th.

Lichfield.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £1,200 for the provision of an overhead line to Whittington Barracks.

Manchester.—NEW PLANT.—The Electricity Committee is to ask the City Council at an early meeting to approve a scheme for works extensions, at a cost of £600,000, and for equipment at £234,000. The engineer, Mr. H. C. Lamb, states that unless arrangements are made to meet the demand for the winter 1928-29, there will be a serious danger of shortage of plant. He proposes a second power house containing two sets of 40,000 kW each. Only one set is required for the present extension. The boilers will be fitted for the use of coal or coke breeze, although the new boiler-house will be designed for the use of pulverised fuel if the plant on order is a success.

Morecambe.—ELECTRICITY CHARGES.—The Town Council has introduced a new scale of electricity charges, which includes as alternatives to the flat rate, a rateable value charge, maximum demand charge, two-rate scale, and a shop-window rate.

North Wales and South Cheshire Joint Electricity Authority.—Details were given at the annual meeting of the North Wales and South Cheshire Joint Electricity Authority held recently at Llandudno of the progress made in connection with the supply of electricity in bulk in the authority's area. The bulk supply of electricity has increased from 8,500,000 kWh in 1922 to 19,500,000 kWh in 1925. In October, 1923, the lines constructed were 111 miles in length, and since that time 260 miles of line has been constructed. The lines extend from Pwllheli in the west to Runcorn in the east. Lines are being constructed to the engineering works at Sandbach and to the borders of Staffordshire. Since 1923 the plant has been increased by 10,000 kW. A comprehensive report of the progress of the erection of the transmission lines was presented by the North Wales Power Company, which shows that nearly 105 lines have been erected and the new dam at Maentwrog is almost completed. It is reported that owing to the nature of some of the foundations exposed for the Gyfynys Hendre, Mur and Trawsfynydd Dams, the designs have had to be modified. The work is now proceeding and good progress is being made.

Preston-Blackpool.—TRANSMISSION LINE.—Owing to the Preston-Blackpool transmission line having to cross the River Ribble opposite the Preston power station, it will be necessary to lay the cables underground, at an increased cost of about £2,000. The Electricity Commissioners have advised the Preston Electricity Committee that, in order to provide for eventual duplication of this line, it should arrange for the towers, which are to be erected under the first part of the scheme, to be so designed as to enable a second set of three conductors to be added later.

South Africa.—WITBANK POWER STATION.—According to the Johannesburg correspondent of the *Financial Times*, the first 20,000 kWh set at the new Witbank station of the Victoria Falls and Transvaal Power Supply Co., has recently been started up This is the only one at present installed of the three sets proposed. The electricity is being transmitted at 132,000 V to Brakpan, where it will be transformed down to 20,000 V for distribution along the Rand. The transmission line, 65 miles in length, is supported by 100 ft. towers, with spans of 1,000 ft. between them.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by the following authorities:—The Silsden Urban District Council, for the supply of electricity in the urban district; and the Cark and District Electricity Co., Ltd., to supply in parts of the rural district of Ulverston. The Gwynedd Trust, Ltd., has applied for the amendment of the Whitchurch, Ellesmere and District Electricity Order so as to include the rural district of Malpas in addition to the areas already mentioned in the Order.

The Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising the Gainsborough Urban District Council to supply electricity in the urban district, and the Millom Urban District Council in the urban district of Millom.

Stirling. — LOANS. — The Town Council has applied for sanction to a loan of £4,000 for mains extensions to supply the Bannockburn Road Housing site, and £3,000 for laying cable for houses, of the Scottish Oil Agency, Ltd., and the London & North-Eastern Railway Co.

Turkey.—ELECTRICAL DEVELOPMENT.—The report of the Société Turque d'Electricité shows that the output of the power station during the past year amounted to 45,825,860 kWh, an increase of 14½ per cent. over 1924. An agreement has been concluded with the Société du Gaz de Kadikeny, to supply electricity to the Asiatic side of the Bosphorus, and in order to provide the additional supply an order has been placed for a new turbo-generator with a capacity of 15,000 kW.

United States.—HYDRO-ELECTRIC DEVELOPMENT.—According to the *Electrical World*, Col. H. L. Cooper has presented to the New York State Water Power Commission an amended application of the St. Lawrence Valley Power Corporation, in which the Frontier Corporation is interested, for a permit to develop 2,400,000 h.p. at Hawkins Point at the foot of Barnhart Island in the St. Lawrence River, 43 miles north-east of Ogdensburg. Detailed plans filed with the Commission show that the Company contemplates the erection of a generating plant of 24 units, each capable of developing 50,000 h.p., on both the American and Canadian sides of the river. It is proposed to build a dam, which would be 130 ft. in height, giving a head of 83 ft. It is proposed to maintain the water level at 246 ft. above sea level, which is virtually the level of Lake Ontario. The total cost of the scheme is estimated at $238,000,000.

Yorkshire.—COLLIERY LINKING-UP SCHEME.—A 33,000-V cable is being laid, to link up the collieries included in the Doncaster Collieries Association. By this means these collieries will be able to pool their surplus electricity, which is mainly generated from waste heat. The laying of the cable is well advanced, and the collieries will be linked up in the course of a month or two.

Tramway and Railway Notes.

Birmingham.—TRAMWAY EXTENSIONS.—Important extensions are to be made to the Corporation tramway system. The chief extensions are from the suburb of Hall Green to Shirley, at the city boundary; and on the Tyburn Road, Erdington, along a new road to be constructed, near to Pype Hayes Park.

Glasgow.—NEW TRAMCAR DESIGN.—In its efforts to compete with the motor-buses, the Corporation is building a Pullman tramcar, which will be a single decker and practically all steel. It will be capable of a speed of from 20 to 30 miles an hour, and will have upholstered seats, small foyers for "straphangers," and a seat for the driver. If the experiment is successful 50 more cars will be built.

Kilmarnock.—ABANDONMENT OF TRAMWAY.—The Corporation has applied for an Order authorising it to abandon its tramway as, owing to the increased working costs, it is not now possible for the undertaking to be worked remuneratively.

London.—METROPOLITAN ELECTRIC TRAMWAYS.—As the result of an inspection of the whole of the Metropolitan Electric Tramways, made recently by the Ministry of Transport, the Company has now received official authority for an increase in the maximum speed of the tramcars from 16 m.p.h. to 20 m.p.h. In certain parts of the system the present authorised speed is lower than the maximum of 16 m.p.h., and in these instances also some further increase will be permitted.

"OVAL" TUBE STATION.—Good progress is being made with the construction of escalators at the tube station at Kennington Oval, and it was hoped to put them into operation on May 8th. The scheme of reconstruction at this station also provides for a new and more commodious booking hall and a new entrance leading to Harleyford Road.

BREAKDOWN.—There was delay on the Underground railway on the morning of April 27th, owing to an electrical defect on the north-bound tube between Waterloo and Charing Cross, which caused a diversion of the traffic during rush hours. Between Charing Cross and Piccadilly services had to be suspended, but were restored after a delay of about two hours.

Worcester.—TRAMWAY IMPROVEMENTS.—In connection with the tramway undertaking which was recently purchased by the Corporation, a recommendation in favour of railless cars has been approved, and the following works are to be carried out:—Fourteen new cars, £22,400; taking up tramway track and repairing roadways, £12,000; adaptation of overhead work, £3,000.

Telegraph and Telephone Notes.

Cuba.—NEW RADIO STATION.—Cuba will shortly possess another radio-telegraph and telephone station, permission having been given by the Government for the construction of the buildings. The station will be sufficiently powerful to communicate with stations belonging to the United Fruit Co. Communication will also be possible with North, South, and Central America and the West Indies; the contract calls for the station being opened in any case by the end of 1930.—*Reuter's Trade Service* (Habana).

Danzig.—NEW RADIO STATION.—A new radio station is being built by the Deutsche Telefunken Gesellschaft at Glettkau, in the Free City of Danzig, for the Danzig Government. It is expected to furnish communication with the rest of Europe.

Germany.—NEW CABLE STEAMER.—A new cable-laying steamer was recently launched by the Blohm & Voss Co., of Hamburg, for the North German Sea Cable Works, of Nordenheim, Germany. The vessel, which is 459 ft. in length, has been designed for use both as a cable-laying and freight-carrying steamer, it having a displacement of 14,550 tons and a cable-carrying capacity of 8,000 tons. It is being used for the laying of the final portion of the new telephone cable between Holland and England, and when this is completed it will lay a new telegraph cable between Emden and the Azores.

Honduras.—RADIO LETTER SERVICE.—The Tropical Radio-Telegraph Co., of Honduras, recently introduced a service of week-end wireless letters between Tegucigalpa and the United States and Canada. The rate per word is 0.15 peso (gold), with a minimum of 20 words. Wireless letters are accepted at the main office up to midnight on Saturday and delivered at their destination on the following Monday morning. The minimum price is 3 pesos, and the language employed must be either that of the country of origin (Spanish) or destination. Code telegrams are not accepted.—*Reuter's Trade Service* (Tegucigalpa).

Haiti.—NEW RADIO STATION.—The Government of Haiti has granted permission and the necessary funds for the construction of a new radio-telegraph station at some point not yet chosen.—*Reuter's Trade Service* (Port-au-Prince).

Spain.—TELEPHONE DEVELOPMENTS.—The National Telephone Co. of Spain is laying underground cables throughout the country and introducing the automatic service and other improvements. Among the main features of the programme are a number of trunk lines between the larger towns. The automatic service has been completed at Santander, a new telephone exchange erected, and a school established for the training of the telephone staff. The new cables in most of the northern and north-western districts will in all probability be completed before the end of the year.

Transatlantic Telephony.—RUGBY EXPERIMENTS.—It is understood that interesting transatlantic radio-telephony tests are to be carried out at the Rugby station shortly. According to the *T. & T. Age*, speech is to be transmitted in an extremely distorted form, in which state it will be completely unintelligible to the ordinary listener. The receiving apparatus in America will filter out the distortion and restore the speech to its original clarity. The filtering device is too costly and complicated to allow of its general use for interception of the messages. Reception could be made still further difficult for unauthorised persons by rapidly varying the distortion, say several times per second, in order to compel the use of perfect synchronisation which is not too easy.

Costa Rica.—NEW RADIO-TELEGRAPH STATION.—The new wireless station belonging to the International Radiograph Co., which has just been erected half way between Cartago and Paraiso high above sea level, has three steel towers 440 ft. high on cement foundations and 1,050 ft. apart; the receiving station has two towers 140 ft. high standing 183 ft. apart. There is a separate electric plant, a residence for the employés, insulated oil storage, and very full general equipment. Messages are received from the United States, Europe, South America, other parts of the world, and ships at sea.—*Reuter's Trade Service* (San Jose).

Radio Notes.

Australia.—GOVERNMENT CONTROL OF BROADCASTING.—It is reported that the Commonwealth Government is likely to take over the whole of the broadcasting operations in Australia shortly.—*Reuter* (Melbourne).

Belgium.—WAVE-LENGTH.—From April 30th Radio Belgique's new wave-length will be 487 metres, and not 508 as was at first reported. The new station at Antwerp radiated a special concert on April 30th on a 265-m. wave.

Bolivia.—NEW STATION.—The recently-organised Radio Club of La Paz has met with much success. According to the terms of its charter, the members will be asked to pay a small initial sum fixed by the directors, collectively sufficient to cover the original cost of the transmitting station. Within a few weeks broadcasting will commence.—*Reuter's Trade Service* (La Paz).

Broadcasting in England and America.—A CONTRAST.—Captain P. P. Eckersley (chief engineer of the British Broadcasting Co., Ltd.), speaking at the annual meeting of the British Science Guild in London, contrasted the system of joint ownership and management as applied by the B.B.C., with private enterprise in America. By amalgamation, he said, the B.B.C. had been able to build up a reputation greater than that of any other broadcasting concern in the world. More people listened to wireless programmes in this country, in relation to the population, than in any other country in the world, and more of the poor people were able to listen; in fact, the B.B.C. fulfilled a public service, and 90 per cent. of the people of the British Isles could listen to programmes on a set which need not cost more than two or three pounds. In America, however, those who found broadcasting of the greatest value (*i.e.*, those living in rural areas) had to reply on expensive sets, because it was only in the cities and towns, where the broadcasting companies were able to broadcast advertisements and so obtain revenue, that real service was given. In Great Britain the stations were erected primarily for the public, but in America the man who erected a broadcasting station did so, in the first place, in his own interests (in order to advertise goods) and afterwards for the public. The B.B.C. was not a trust, but a public service. He did not see why, because the principle of trade directorship of the organisation was to be discontinued and seven men who were absolutely independent of the Press, the trade, or any commercial enterprise, were to be appointed to the board, it should be said that broadcasting would be subject to Government control. If the report of the Broadcasting Committee were adopted by the Government, the B.B.C. would continue its activities in the same way as it had done hitherto. Unified control, and the application of scientific methods, had enabled the B.B.C. not only to serve all the country, but to put into operation methods which competitive organisations would never have been able to apply. For example, any great man's speech could be broadcast to every part of the British Isles, but that could not be done under the American system, because of disagreement between competitive organisations.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Australia.—MELBOURNE.—June 16th. City Council. Turbo-alternator, exciter, and condensing plant.*

BRISBANE.—August 26th. City Electric Light Co., Ltd. One 12,500-kW turbo-alternator.*

Adwick-le-Street.—May 19th. Urban District Council H.p. switchgear and cables, step-down transformers, l.p. distribution gear, pillars, cables, joint boxes, &c. (April 16th.)

Belgium.—May 12th. Municipal authorities of Schaerbeek, Brussels. 600 armoured circuit breakers. Particulars (Cahier des Charges) from the Service de l'Electricité, Hotel de Ville, Schaerbeek.

Bristol.—May 13th. Electricity Department. One 7,000-kW turbo-alternator, with condensing plant and auxiliaries. (April 30th.)

Canada.—June 2nd. Department of Public Works. One 25-ton electrically-operated portal crane for Esquimalt Dry Dock.*

Cairo.—Egyptian State Railways, Telegraphs and Telephones. Underground cables. Chief Inspecting Engineer, Queen Anne's Chambers, Broadway, Westminster, S.W.1.—*Reuter's Trade Service* (Cairo).

Cheadle and Gatley.—May 10th. Urban District Council Electricity Department. Single-phase alternating-current meters required during year ending March 31st, 1927. Form of tender from Mr. R. W. Willis, engineer and manager, 37, High Street, Cheadle.

Dundee.—May 20th. Electricity Department. A.c. and d.c. house-service meters for 12 months. (See this issue.)

Farnworth. — May 14th. Electricity Department. cables, street-lighting pillars, pillars and boxes, cut-outs and meter boards, and meters. (April 30th.)

Hull.—May 20th. Electricity Department. Underground cables. (April 30th.)

Telephone Committee. Copper jointing sleeves. (See this issue.)

Ilford.—May 11th. Electricity Department. One 1,000-kW La Cour motor converter. (April 30th.)

India.—India Store Department. May 11th. One 200-kW La Cour-type motor converter. (April 23rd.)

May 14th. Three 5-kW oil engine-driven generator sets, one switchboard, and two pumping sets.*

May 15th. Madras and Southern Mahratta Railway Co., Ltd. Telephone line material (comprising porcelain insulators, galvanised terminal irons, &c.), copper line wire (1,302 miles), copper binders, tapes, &c. (April 23rd.)

May 18th. Porcelain insulator cups. (April 30th.)

June 15th. 70,000 copper bonds for track rails.*

Leeds.—May 15th. Library and Arts Committee. Electric lighting at Public Library, Hough Lane, Bramley. Particulars from Messrs. Foggitt & Addison, architects, 3, Park Place, Leeds.

London.—METROPOLITAN ASYLUMS BOARD.—May 19th. Installation of electric cable, &c., for arc-light treatment apparatus. (April 30th.)

PADDINGTON.—May 21st. Great Western Railway. Electric wire and cables. Specification from the Stores Superintendent, Swindon.

Manchester.—May 11th. Tramways Committee. Electric tramcar bodies, trucks, motors and controllers. Specifications from Mr. H. Mattinson, general manager and chief engineer, 55, Piccadilly, Manchester.

May 20th. Electricity Committee. Potential and current transformers, cable supplies, electric kettles, and electrical meters for 12 months. (See this issue.)

May 11th. Board of Guardians. Electric cables for the Crumpsall Institution. Particulars from E. Hargreaves, Superintendent of Works, Union Offices, All Saints, Manchester.

Middlesbrough.—Electricity Department. Extension of electricity supply distributors, total length approx. 1,000 yd. (April 30th.)

New Zealand.—AUCKLAND.—June 21st. Electric Power Board. L.p. insulators, &c.*

WELLINGTON.—May 12th. Post and Telegraph Department. 18 switchboards.*

Public Works Department. July 20th. Phase transformer for Mangahao electric power scheme.*

New Zealand Railway Department. June 16th. Electric motors.*

DUNEDIN.—May 28th. Otago Harbour Board. One portable electrically-driven cargo stacker.*

Nottingham.—May 31st. Board of Guardians. One 60-kW d.c. turbo-generator, &c., and alterations to main switchboard, &c. (April 16th.)

South Africa.—JOHANNESBURG.—Municipal Council. 8 miles h.p. cable, 41 miles l.p. cable.*

CAPE TOWN.—June 3rd. South African Railways and Harbours. One motor-starting panel.*

June 10th. D.c. electric generating plant (suction gas).*

Southern Rhodesia.—June 21st. Department of Posts and Telegraphs. Automatic telegraphs. Automatic telephone exchange for Salisbury. (April 23rd.)

Stockton-on-Tees.—May 10th. Electricity Department. Paper-insulated cables, a.c. meters, and house-service cut-outs. (April 30th.)

Walthamstow.—May 12th. Electricity Department. One 1,500-kW motor converter. (April 23rd.)

Warrington.—May 10th. Electricity Department. E.h.p. sub-station truck-type switchgear. (April 23rd.)

Waterford.—May 12th. Electricity Department. Two 250-kVA, 3-phase alternators direct coupled to heavy oil engines, e.h.p. mains and l.p. underground distribution system, transformer kiosks, pillars, street lighting services, l.p. overhead distribution system, &c. (April 9th.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Aberdeen.—Electricity Committee. Accepted:—
10,000-kW turbo-alternator, with condensing plant (£38,000).—English Electric Co., Ltd.

Australia.—SYDNEY.—The following is the list published by the Sydney *Daily Telegraph* of the tenders submitted for the turbo-alternators for the Bunnerong station of the Sydney Municipal Council:—

Tenderer.	Total price after deducting spare parts.	Australian manufacture.
English Electric Co. of Australia, Ltd. ...	£492,351	—
Metropolitan-Vickers Electrical Co., Ltd. ...	502,500	—
Allgemeine Elektricitats Gesellschaft ...	503,550	—
C. A. Parsons & Co., Ltd.	552,307	—
Australian General Electric Co., Ltd. ...	565,117	35 per cent.
Ditto, alternative (recommended by the acting chief electrical engineer) ...	606,778	33 per cent.
English Electric Co. of Australia, Ltd. ...	619,173	96 per cent.
British General Electric Co., Ltd.	636,333	?
Commonwealth Shipping Board (with Metropolitan-Vickers). Accepted ...	**661,224**	**55 per cent.**
Ditto, alternative	685,386	63 per cent.
Schneider & Co.	692,656	—
Brown Boveri & Co., Ltd.	721,161	?
Sir W. G. Armstrong, Whitworth & Co., Ltd.	764,200	—

The figure of £666,605, at which the Commonwealth Shipping Board's tender has been accepted, includes a few extras that have been omitted in this schedule, in order to make the tenders comparable. Only machines running at 1,500 r.p.m. (the recommended speed) have been included.

At a special meeting of the Council held on March 22nd, the Town Clerk stated that the following cable message had been received from Mr. Mackay (general manager):—

"Yours eighteenth Bunnerong turbines: Council's decision obviously not based on commercial or technical considerations; therefore comment by me difficult. Commercially and technically 'B.T.-H.' (British Thomson-Houston) tender better. Even allowing for Council's desire to place order with local publicly-owned works, I think it imprudent order six turbines Cockatoo, because order too big for inexperienced establishment to complete in time. Failure to put Bunnerong into operation early 1928 would be a catastrophe. Dividing order between Cockatoo and 'B.T.-H.' would secure completion of some plant by 1928."

A later message from Mr. Mackay was as follows:—

"Further by cable to-day: Situation discussed with Payne, manager Cockatoo, and as result I recommend if six turbines ordered Cockatoo that special arrangement be made for early completion first two. Suggest Council agree to importation by Cockatoo increased percentage parts first two turbines on condition that percentage imported parts reduced last two."

After considerable discussion the Council, on a vote, declined to reconsider the decision to give the contract for turbo-alternators to the Commonwealth Shipping Board for construction at the Cockatoo Dockyard.

A further resolution was passed giving the city electrical engineer power to "negotiate" with the Commonwealth Shipping Board for the additional variation of the tender, on the lines indicated in the cablegrams of Mr. Forbes Mackay, to permit of additional units being imported from Britain, so as to ensure the delivery of the plant from Cockatoo in the time specified under the contract conditions.

Brighton.—Lighting Committee. Accepted:—
Switchboard (£849); duplicate cell regulating switches (£625).—Bertram Thomas.
Booster (£654).—Bruce Peebles & Co., Ltd.
Steam turbine-driven rotary feed pump (£355).—G. & J. Weir, Ltd.
3,000 yd. .1-in. cable (£570).—Standard Telephones & Cables, Ltd.

Chester.—Corporation. Accepted:—
New battery at the Crone Street electricity works (£13,600, less £1,466 for the scrap lead).—Tudor Accumulator Co., Ltd.

Coulsdon.—Housing Committee. Accepted:—
Wiring on housing estate (12s. 6d. per point).—G. S. Hawker, Ltd.

Croydon.—Electricity Committee. Recommended:—
Switchgear at Drummond Road sub-station (£761).—A. Reyrolle and Co., Ltd.
Two transformers for Drummond Road sub-station (£810).—British Electric Transformer Co., Ltd.

Dover.—Electricity Committee. Folkestone-Dover cable. Supply of 6,250 yd. .1 sq. in. 3-core paper-insulated cable, including laying, jointing, testing, &c., and the provision of all necessary boxes:—

Macintosh Cable Co., Ltd.	£4,755
Hackbridge Cable Co., Ltd. (Recommended.)	**4,413**
Watshams, Ltd.	4,290
Enfield Cable Works, Ltd.	4,782
W. T. Henley's Telegraph Works Co., Ltd.	4,804
Johnson & Phillips, Ltd.	4,825
Standard Telephones & Cables, Ltd.	4,803
Pirelli-General Cable Works, Ltd.	4,764
W. T. Glover & Co., Ltd.	4,815
Siemens Bros. & Co., Ltd.	4,684
British Insulated Cables, Ltd.	4,810
Callender's Cable & Construction Co., Ltd.	4,889

The Committee ruled out the third of the above tenders, which was for cable of Belgian manufacture.

Durham.—County Education Committee. Accepted:—
Electric light installations at Station Town School (£128), Simm and Richardson; at West Cornforth New School (£376), F. Reid Ferens and Co.

Erith.—Urban District Council. Accepted:—
Cable (£1,388).—Callender's Cable & Construction Co., Ltd.
Switch cubicle (£182).—Fraser & Chalmers Engineering Works.

Folkestone.—Town Council. Accepted:—
Electric light fittings for the Leas Cliff Hall (£540).—Metro-Vick Supplies, Ltd.

Halifax.—
Electrical work in connection with 40 Corporation houses at Nursery Lane and 40 houses at Booth Town.—A. Higginbotham & Sons.

Hornsey.—Electricity Committee. Recommended:—
Wiring 108 Council houses (£874).—E. Wright & Co.

London.—ISLINGTON.—Board of Guardians. Electric lighting installation (mains and power) for the Guardians' schools, Andover Row, Hornsey Road, N. Mr. Edmund J. Harrison, architect:—

Simplex Electric Lamp Co., Ltd.	£4,750
J. M. Jamieson	2,300
Dalziel Engineering Co.	2,020
Smethurst & Co.	1,818
McHow & Haynes	1,797
W. C. Clutton	1,600
Electrical Installations, Ltd.	1,567
E. H. Finn	1,427
Higginbotham & Co.	1,400
Ridout & Ratcliff	1,392
P. M. Braidwood	1,385
Ellis & Ward	1,349
Locke & Soares	1,310
G. A. Weston	1,308
Morris Electrical Co., Ltd. (Accepted.)	**1,225**

Lancaster.—Corporation. Accepted:—
E.h.p. cables.—British Insulated Cables, Ltd.

Lichfield.—Town Council. Accepted:—
Electricity meters for one year.—Measurement, Ltd.

Peterborough.—We are informed that the statement appearing in our last issue to the effect that the Town Council had accepted a tender of International Combustion, Ltd., for boiler plant at £34,190 is incorrect; that company did not tender.

Reigate.—Electricity Committee. Accepted:—
Supply and erection of a fly-wheel alternator for the new six-crank engine (£2,535).—Electric Construction Co., Ltd.

Rothesay.—Electricity Works. Accepted:—
One battery of 268 13-plate S.T.C.-type cells, capacity 600 amp.-hr.—Hart Accumulator Co., Ltd.

Salford.—Education Committee. Accepted:—
Electric lighting installation (£169).—County Electrical Co.

Tramways Committee. Accepted:—

Stores for 12 months:—
Commutator segments.—Manchester Armature Repair Co., Ltd.
Insulating tapes.—L. Andrew & Co.
Gear and pinion wheels.—British Hele-Shaw Patent Clutch Co., Ltd.
Steel tires.—Hadfields, Ltd.; Brown Bayley's Steel Works, Ltd.
Brake blocks.—Pease & Partners, Ltd.

Wanstead.—Essex Education Committee. Accepted:—
Installing electric light at Wanstead County High School (£699).—H. A. Neale & Co.

York.—Electricity Committee. Accepted:—
Cable (£8,050).—Callender's Cable & Construction Co., Ltd.

Forthcoming Events.

Junior Institution of Engineers.—Friday, May 7th. At 39, Victoria Street, S.W. At 7.30 p.m. Lecturette on "Distortion in Wireless Reception," by Mr. A. V. Ballhatchet.
Friday, May 14th. Paper on "Static Transformer Testing and Test Plant Requirements," by Mr. L. Smith.

Electrical Association for Women.—Friday, May 7th. At the Criterion Restaurant, Piccadilly, W. At 1 p.m. Luncheon.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, May 8th. At Brecon. Annual meeting.

London Association of Foremen Engineers.—Saturday, May 8th. At the Cannon Street Hotel, E.C. At 6 p.m. 73rd Anniversary Festival.

Institute of Physics.—Tuesday, May 11th. At the Royal College of Science, South Kensington, S.W. At 5.30 p.m. Lecture on "The Relationship of Physics to Aeronautical Research," by Mr. E. H. Wimperis.

Royal Society of Arts.—Wednesday, May 12th. At John Street, Adelphi, W.C. At 8 p.m. Paper on "Industrial Welfare in Practice," by Mr. W. S. Bradley.

Radio Society of Great Britain.—Wednesday, May 12th. At the Institution of Electrical Engineers. At 6 p.m. Informal meeting.

Institution of Electrical Engineers (North-Western Centre and Mersey and North Wales (Liverpool) Centre).—Wednesday, May 12th. Reunion at Chester.

Institution of Production Engineers.—Wednesday, May 12th. At 83, Pall Mall, S.W. At 7.30 p.m. Paper on "Inspection Methods," by Mr. A. Butler.

Royal Institution.—Thursday, May 13th. At 21, Albemarle Street, W. At 5.15 p.m. Lecture on "The Imperfect Crystallisation of Common Things," by Sir William Bragg.
Saturday, May 15th. At 3 p.m. Lecture on "Atmospheric Electricity," by Dr. G. C. Simpson.

Faraday Society.—Thursday, May 13th. At the Institution of Mechanical Engineers, Storey's Gate, S.W. From 2.30 to 4.30 and 5 to 6.30 p.m. Discussion on "Explosive Reactions in Gaseous Media."

Birmingham Electric Club.—Friday, May 14th. Visit to the works of the English Electric Co., Ltd., and Siemens & English Electric Lamp Co., Ltd., at Preston.

Physical Society of London.—Friday, May 14th. At the Imperial College of Science, South Kensington, S.W. At 5 p.m. Ordinary meeting.

Notes.

School Lighting.—A paper on this subject was read by Dr. James Kerr, late School Medical Officer for London, at the meeting of the Illuminating Engineering Society on April 29th. He pointed out the special needs of children with regard to light; to them letters were unfamiliar and good illumination was even more needful than to the adult. Statistics showed that about a third of the children in schools failed to retain normal vision. The lecturer attached great importance to proper shading of light sources, especially in view of the general use of gasfilled lamps. He was disposed to recommend that no sources within the direct range of vision should have a greater brightness than 3 c.p. per sq. inch. Reference was made to interesting results obtained in the schools of Cleveland, U.S.A., where an average illumination of a little over 5 foot-candles is provided, and diffusing glass units with a brightness not exceeding 3 candles per sq. in. are used. Referring to the question of the colour of light, Dr. Kerr reported favourably on personal experience with a portable lamp equipped with Lamplough glass, and suggested that the question of the colour of light deserved attention in schools occupied by myopic children. During an interesting discussion which followed the lecture, Mr. C. Hughes exhibited a pleasing form of totally enclosed unit and several examples of modern reflectors equipped with half-frosted lamps, which were recommended for school lighting. Capt. Halsted Hanby showed examples of units equipped with tinted glass, of the type mentioned by Dr. Kerr, and Mr. L. Gaster referred to the work being done by the Committee on the Ideal Classroom and to the various American Codes of School Lighting, which advocated methods substantially in agreement with those recommended by the Society. Dr. Nash dealt with the subject from the standpoint of the medical officer.

The Electrical Trades Benevolent Institution.—Annual General Meeting.—On April 29th the annual general meeting of the E.T.B.I. was held at the Institution of Electrical Engineers. Mr. R. A. Chattock, president I.E.E., presided, and moved the adoption of the annual report of the Committee of Management and the accounts.

The report stated that the income from contributions for the year was £1,953, making with other receipts a total income of £3,128. After the payment of grants and expenses, £1,894 had been carried to the capital account. In respect of the year £773 had been invested, bringing the total invested funds at cost to £24,606. The number of grants had increased from 70 to 81; every qualified applicant received assistance. The Local Advisory Committees had increased the contributions and made the Institution better known, and the Committee hoped that further Committees would be created, for which purpose the co-operation of leading persons in the large towns was invited.

The annual festival was held on November 4th; Mr. E. S. Barralet presided, and his appeal brought in £1,389. The attendance was the largest recorded.

A new set of rules was under consideration, with a view to enrolling more contributing members and to simplifying the granting of assistance.

Commenting on the report, the Chairman compared the income for the year, £3,128, with that of the previous year, £3,810; the expenditure amounted to £299, compared with £292 in 1924, and included an item for travelling expenses of the hon. secretary in attending meetings in the provinces, from which good results were anticipated. The grants for temporary aid had increased in number from 70 to 81, and in amount from £899 to £935, figures previously unapproached; the cause was, first, the unsatisfactory state of trade, and secondly, the fact that the Institution was becoming more widely known. It had been more difficult to find employment for those who sought assistance than in any previous year. The invested funds cost £24,606, and their market value at the end of the year was £24,541, from which it was seen that the money had been well invested. The funds did not benefit so much by legacies as those of other institutions did. The E.T.B.I. and the Benevolent Fund of the I.E.E. kept closely in touch to avoid overlapping, and in some cases shared the cost of the grants. The Committee had been revising the Rules of the Institution, and when the work was completed, a special general meeting would be held to bring them into force.

Mr. J. Y. Fletcher having seconded the motion, the report and accounts were unanimously adopted.

Members of the Committee retiring by rotation were re-elected, and new members, Messrs. A. G. Beaver and J. E. Edgecombe, were elected. The hon. auditors, Messrs. Price, Waterhouse & Co., and the hon. solicitors, Messrs. Sugden, Bextall & Beal, were re-elected, and votes of thanks were passed to them, to the Press, and to the I.E.E. for the use of the room.

The Chairman referred to the presence of Mr. E. S. Barralet, president at the last Festival, and moved a vote of thanks to him for the services he had rendered to the Institution, which was warmly accorded; and the proceedings concluded with a vote of thanks to Mr. Chattock for presiding, moved by Mr. J. Y. Fletcher.

Appointments Vacant.—Electrical engineer, for the Aldershot Gas, Water and District Lighting Co.; telephone engineer for Singapore (£46 per month approx.), for the Oriental Telephone & Electric Co., Ltd.; Principal, for the Stafford County Technical School (£600); assistant electrical engineer ($400 per month+dollar=2s. 4d.), for the Government of the Federated Malay States; assistant electrical foreman, for the Gun Carriage Factory, Jubbulpore. (See our advertisement pages to-day.)

Urban Tramways.—That the tramway undertakings throughout Great Britain now carry more than 4,000 million passengers during the year and that their annual revenue exceeds £29,000,000 are facts which Mr. A. A. Jackson made evident in his recent paper before the Midland Section of the Institute of Transport. He dealt mainly with passenger fares, remarking that by certain recently promoted special Acts of Parliament, authority had been obtained to charge at a rate not exceeding 1½d. per mile per passenger. It had not been found practicable, or advisable, to introduce overlapping fare-stage points much less than half-a-mile apart. In a few towns contract or season tickets for periods of a week, month, or quarter had been issued. They were good for any number of rides and irrespective of the inidividual user, as it had proved to be practically impossible to make them non-transferable. Their general use was open to serious abuse on account of the multiplicity of fare stages and the difficulties of inspection and check. The price of all-day shilling tickets, usually issued on any day and available for any number of trips, was too high to permit of serious misuse. Transporta-

tion service could not be sold at a fixed price, but the price must vary from time to time with the cost of producing such service. Local conditions played a most important part in the fixing of fares. An adequate revenue must be secured and the ride must be paid for fully by the rider.

The Volta Centenary Celebrations.—The Committee which is organising the Volta Centenary celebrations which are to be held in Como, Italy, from May to October, 1927, has just commenced the publication of a monthly magazine with the title "Voltiana" dealing with the life work of the famous scientist and giving full particulars of the celebration preparations that are being made. Copies can be obtained from 11, Via Unione, Como, Italy.

London Electrical Engineers.—27TH (LONDON) ANTI-AIRCRAFT BATTALION, R.E. (T.A.).—Officer Commanding: Lieut.-Colonel C. H. S. Evans, O.B.E. The following orders have been issued for May:—304th Company, Major P. F. Foulger; 305th Company, Major A. W. M. Mawby, O.B.E., Tuesdays, 7 p.m. to 9.30 p.m. 306th Company, Major F. C. Clarke, Mondays, 7 p.m. to 9.30 p.m. Technical training is being dealt with very fully up to the annual training, which is being held this year from July 25th to August 8th at Manston (near Margate). A selected detachment of the unit will take part in training at Whitsuntide. Efforts are being made for an extensive recruiting campaign from May 10th to May 12th, when it is hoped with the generous assistance of employers to materially raise the strength of the unit.

Canadian Water Power.—The Toronto correspondent of *The Times* says that the Premiers of Ontario and Quebec have agreed to unite to defend their constitutional rights against any encroachment upon the power of the Provinces to control the generation and distribution of hydro-electric power.

The same correspondent reports that a provincial charter has been granted to the Spruce Falls Power and Paper Company authorising the construction of a hydro-electric power plant, and pulp and paper mills near Kapuskaing on the water courses to Hudson Bay. The New York *Times* is jointly interested in the new company. The enterprise involves the investment of $25,000,000, and the estimated daily production of the plant is 500 tons of paper and upwards of 120 tons of sulphite, also electric power for industrial purposes.

Social Event. — On April 24th, the staff of the Reigate Corporation electricity works celebrated the undertaking's 25th anniversary by a supper and social, presided over by Mr. T. W. Reed. The Mayor attended, accompanied by members of the Electricity Committee, and representatives of several electrical firms were present. During the evening Mr. W. S. Ross, the borough electrical engineer, who has been with the undertaking since its inception, was presented with an inscribed silver watch and a handbag for Mrs. Ross. The toasts included "The Mayor and Corporation," "The Borough Electrical Engineer and Staff," "The Contractors," and "The Visitors." A musical entertainment was provided.

Electric Milking Plant.—Mr. F. Swarbrick, borough electrical engineer, Basingstoke, has supplied particulars of cow-milking by electricity in practice, on the farm of Mr. Tom Bowden, Sherborne St. John, where some 64 dairy cattle are milked by equipment that was installed in August, 1925. According to the *Daily Telegraph*, tests showed that the cows were milked in 1¼ hours, and the consumption of the electric motor was 2.475 kWh, at 3d. per kWh, or 7.425d. Therefore the cost of electricity per day for milking 64 cows is 1s. 3d., and one man and two lads were required to do the whole work, whereas under the hand-milking system three men and three lads were necessary. This alone constitutes a saving of £5 10s. per week. Spread over a year, under the old system, the wages of three men at £6 per week, were £312 and three lads at £4 10s. per week £234, a total of £546. Under the new method the full cost is £332 5s., or a total saving of £213 15s. per year. The costs of the new method are: One man at £2 a week, £104; two lads at £3, £156; interest on capital expenditure at 5 per cent., £16 10s.; depreciation at 10 per cent., £33; and cost of electricity at 1s. 3d. per day, £22 15s. Although depreciation is taken at 10 per cent., it is very unlikely, contends Mr. Swarbrick, that this figure would be reached, as the whole installation is so well designed and constructed. The milk supplied at this farm is Grade A, T. T., and the official yield for last year was 900 gallons per cow.

Barrow Hydro-electric Scheme.—Last week, at Barrow Town Hall, Colonel T. C. Ekin, M.Inst.C.E., on behalf of the Electricity Commissioners, inquired into the application of the Barrow Corporation for consent to establish an hydro-electric station at Backbarrow, on the River Leven, and for sanction to borrow £90,000 for the purpose, this being £78,000 for the proposed station and £12,000 for transmission lines. The Town Clerk (Mr. L. Hewlett) was in charge of the case for the Corporation and opposition to the scheme came from four sources The Kent, Bela, Minster, Leven and Duddon Fishery Conservators, and Lord Richard Cavendish, owner of the salmon fishery of the river, represented by Mr. S. Hart Jackson, junr.; Ulverston Rural District Council, represented by Mr. N. E. Barnes; Barrow Property Owners' Association and Barrow Chamber of Trade, represented by Mr. J. Pickavance; and Barrow Ratepayers' Defence Association, represented by Mr. John Jackson. The Town Clerk submitted that the proposed scheme was a sound, practical one, and in support he called Alderman W. Fairbairn, J.P., chairman of the Corporation's Negotiating Committee, to explain the need for the scheme. Mr. H. R. Burnett, borough electrical engineer, explained the position at the Corporation's works in Buccleuch Street, Barrow, where the load factor was very high, and he gave statistics showing the necessity for the proposed station. The revised estimated cost of construction, based on Messrs. Vickers's tenders, plus the estimated cost of fish passes, was £90,000. A flow of 750 cu. ft. per sec. at 33 ft. effective head had been taken as representing the maximum output of the proposed plant (1,500 kW) and the output available for a year would be approximately 5,760,000 kWh generated. The total estimated annual cost of production would be £10,020 (£7,658) or 0.534d. (0.408d.) per kWh on an average anticipated output of 5 million kWh. The figures in parenthesis represented the estimated costs in the event of a Government grant being obtained, amounting to 50 per cent. of the interest on the capital expenditure (*i.e.*, £2,362 per year).

Mr. Burnett said the Corporation was prepared to make certain fish passes, and to meet some of the needs of the Ulverston Rural Council; he pointed out that only once in 27 years had the electricity department had a loss, and that was a very small one. He agreed that Messrs. Vickers had "a super-power station" at Barrow, but it was better, in his opinion, to have the Backbarrow station.

Mr. R. W. Hogarth, M.Inst.C.E., of Messrs. Buchan and Partners, Westminster, an expert on hydro-electric stations, gave evidence in support of the scheme. After full inquiry into all the circumstances and data he estimated that on the basis of 1925, which was a dry year, there would have been six million kWh generated, and after deducting 800,000 kWh for compensation and 56,000 kWh for works and losses, he arrived at 5,144,000 kWh. The supply would be the cheapest obtainable, and the scheme was excellently laid out. The opposition with regard to fishing in the river was met by arrangement.

The Ulverston Rural District Council's opposition related to certain water supplies for works and domestic purposes; eventually there was an agreement with the Rural Council, subject to the decisions of the Electricity Commissioners.

The contention of the Barrow Property Owners' Association and the Barrow Chamber of Trade was that owing to the bad financial position of the town the scheme should be postponed and that a further arrangement should be made with Messrs. Vickers, Ltd., for any extra electricity necessary.

Mr. John Jackson, of the Barrow Ratepayers' Defence Association, handed in a petition bearing 10,157 signatures demanding that a referendum be taken in the town on the scheme.

Colonel Ekin pointed out that it was addressed to the Mayor, Aldermen and Councillors. Why was it presented to him? On the first sheet were two signatures which appeared to be those of a ratepayer and his wife. It seemed to him incredible that in a town of 15,000 ratepayers there should be over 10,000 signing the petition.

The Town Clerk, in completing the inquiry, submitted that he had proved by evidence that the scheme was a sound one, which would overcome the Corporation's difficulties for some years to come. There was not the slightest chance of the scheme being a charge on the rates, and he stressed the point that a supply authority should not be dependent for its electricity upon a private firm.

A New Alloy Steel.—Sir Robert Hadfield last week, announced at Sheffield the discovery of a new alloy steel capable of withstanding abnormally high temperatures. A gas turbine wheel made of the new steel had been tested at 55,000 revolutions a minute, so that it was working at a temperature of 800 to 900 deg. C., being brought to a very bright red heat without its efficiency being impaired. The new steel, he said, would no doubt help to solve many industrial problems in the application of high-temperature gases.

The British Association.—As has been previously announced, the 1927 meeting of the British Association for the Advancement of Science is to be held in Leeds. Last week the period was fixed as from August 31st to September 7th.

Electrical Association for Women.—A lecture on "Lighting" was given in the Medical Theatre, Birmingham University, on April 28th, to the Birmingham and Midland Branch of the Electrical Association for Women by Mr. C. McDonald, chief electrical engineer of the Birmingham Post Office. He traced the growth of artificial lighting and gave practical demonstrations of the developments in electric lamps, illustrating by means of slides the various systems of lighting—direct, indirect and semi-indirect. In discussing household illumination he emphasised the importance of decoration in relation to light.

Institution of Engineers-in-Charge (Inc.). — ANNUAL DINNER.—On Friday last the annual dinner of the Institution of Engineers-in-Charge was held at the Holborn Restaurant, London; the president, Engineer-Vice-Admiral Sir Geo. G. Goodwin, K.C.B., was in the chair, and covers were laid for about 270 members and guests.

After the loyal toasts, Mr. L. Pendred, M.I.Mech.E., vice-president, proposed "The Lord Mayor, the Sheriffs, and the Corporation of the City of London," remarking that it was 16 years since the Institution had been honoured by the presence of the Lord Mayor; it was the only engineering institu-

tion domiciled in the City. He referred to the educational engineering work accomplished by the Guilds of London, which had done much to raise the status of engineers, and expressed a hope that the Lord Mayor would use his influence towards rectifying the Fleet order by which naval engineers had suffered injury.

In reply, the Lord Mayor, Col. Sir W. R. Pryke, acknowledged the indebtedness of the community to the work of engineers and engineering institutions, and said that the Livery Companies were all glad to do what they could for the public welfare. Proposing "The Institution," Eng.-Vice-Admiral Sir Robert B. Dixon, K.C.B., remarked that the Institution was now 25 years old, and complimented it on the high standard of its papers and discussions; there were many institutions, he said, some of which overlapped, but the Institution of Engineers-in-Charge poached on no-one's preserve. He congratulated the Social Committee on its excellent work, and was glad to see that the benevolent fund was in a very satisfactory position. At sea, he said, they watched closely the progress of engineering on land, and recently a ship was launched whose boilers would work at 500 lb. pressure. Responding, the President pointed out the unique circumstance that the toast was proposed by the Engineer-in-Chief of the Fleet, and responded to by the previous holder of that position —with whom he had always worked most harmoniously. The Institution, he said, was very particular regarding the qualifications of candidates for membership, a regular works training being an indispensable requirement. The proceedings contained many valuable papers. The formation of a Students' Section was in contemplation.

Mr. W. Edwards, vice-chairman, proposed "Our Guests and Friends," expressing the gratitude of the Institution for their help and guidance, and Mr. R. A. Chattock, president I.E.E., responding, remarked that his old friend, Mr. Frank Bailey, who gave him his first job as an engineer-in-charge, was present. There were three institutions catering for engineers-in-charge, the others being the E.P.E.A. and the S.T.E. Could they not amalgamate, with advantage, and thus strengthen the position of the young engineer? He cordially agreed with Mr. Pendred regarding the Admiralty order; the I.E.E. would do all that was possible to further the interests of engineers in the Navy and to maintain their status. The engineers-in-charge of small central stations were concerned as to their future under the new Bill, but the electricity supply industry was growing so fast that there would be plenty of outlets for their energies in connection with distribution.

Mr. J. M. Dawson proposed "Our President" in felicitous terms; the toast was accorded musical honours, and the President, in response, paid a tribute to the work of the hon. secretary, Capt. A. E. Penn, and the Chairmen of Committees. The normal membership was 500; but 50 new members were being enrolled in one year. With regard to naval engineers, the officers serving could not speak, but it was a fact that the loss of the purple stripe took a great deal away from the engineer officers, though it did not greatly affect the executive officers. He was glad that action was being taken by the Institutions in this matter.

Amongst the guests not mentioned above were Dr. Alex. Russell, F.R.S., past-president I.E.E., Sir Joseph Petavel, K.B.E., F.R.S., and Mr. W. McClelland, C.B., O.B.E.

A very good entertainment added to the pleasures of the evening.

Junior Institution of Engineers' Dinner.—The annual dinner of the above-named Institution was held at the Café Monico, London, on April 27th, the forty-seventh anniversary of its foundation. The president (Mr. J. S. Highfield) occupied the chair, and was kept busy with a host of unofficial toasts called for by Mr. Tookey with the aid of a business-like spanner. The principal guests included Sir Frank Dyson (Astronomer Royal), Mr. W. Reavell (president of the Institution of Mechanical Engineers), Air Vice-Marshal Sir W. Sefton Brancker (Director of Civil Aviation), Air Vice-Marshal Sir Vyell Vyvyan, Col. The Master of Sempill, and Mr. J. P. Rowen (chief engineer, Trinity House Corporation). Sir W. Sefton Brancker, who has accepted a vice-presidency of the Institution, prompted other speakers to make references to the speed of travel, while both Mr. W. J. Tennant and Mr. W. Reavell made a plea for a greater appreciation amongst engineers of the commercial side of engineering, the former remarking that if ever he should make a million he would found a Chair of Engineering Economics; meanwhile, perhaps someone who had a million would take the hint. During the evening Miss Bessie Kerr sang well, and Mr. L. Hamilton "entertained," Mr. R. Cooper being at the piano.

Institution Notes.

Institution of Electrical Engineers. — North-Eastern Centre.—The annual general meeting of the above Centre was held on April 26th, when the annual report of the Committee was presented. The membership of the Centre at the end of the session 1925-26 was 509, as compared with 512 at the end of the previous period. The new officers and Committee for the next session were appointed. The chairman will be Mr. J. Rosen, M.I.E.E.; vice-chairmen, Messrs. Hugh Paterson, A.M.I.E.E., and E. Fawssett, M.I.E.E.; hon. sec., Mr. P. F. Allan, M.I.E.E.

Institution of Public Lighting Engineers.—The third annual meeting and conference of the above Institution will be held at Newcastle-upon-Tyne in September. Application has been made to the Ministry of Health in respect of the expenses of the delegates attending the meeting, and a reply has been received to the effect that the Minister of Health will be prepared to consider applications from local authorities whose accounts are subject to Government audit for sanction to the payment of the expenses of the attendance at the meeting and conference of not more than two delegates, one of whom should be the engineer or superintendent for public lighting in the district.

The Röntgen Society.—A general meeting will take place on Thursday, May 20th, at 8.15 p.m., in the Barnes Hall of the Royal Society of Medicine, London, when the seventh Mackenzie Davidson Memorial Lecture will be delivered by Dr. A. Dauvillier, Paris, the subject being "The Measurement of X-ray Dosage."

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements).

The *Journal* of the Associated Chambers of Commerce in China and Hong Kong reports that Mr. P. B. Critchley, who has been associated with the Shanghai Municipal Electricity Department for 25 years, has retired. He was to return to England by the *Empress of Scotland*.

At a recent meeting of officials and staff of the Lincoln electricity undertaking, Mr. Stanley Clegg was presented with a travelling case to mark his completion of 25 years' service as chief engineer. Mrs. Clegg received a scent spray.

Mr. A. Hewitt and Col. Cortez Leigh have been re-elected chairman and vice-chairman respectively of the North Wales and South Cheshire Joint Electricity Authority for a further period of three years.

We are pleased to learn that Mr. Guy Burney, who recently underwent a serious operation to his ear, is making satisfactory progress.

The Times states that the Carnegie Hero Fund Trustees have awarded the bronze medallion, their highest award, and an allowance of £200 per annum to Dr. George Alexander Pirie, Dundee, who has become permanently incapacitated as the result of injuries received through engaging in X-ray work.

The French Académie des Sciences has awarded the Gaston Planté prize for 1925 to M. Joseph Bethenod, of the Ecole Supérieure d'Electricité, Paris, for his work on the generation and utilisation of high-frequency alternating currents. The Hebert prize has been awarded to M. Edouard Roth, of the Société Alsacienne de Constructions Mécaniques, Belfort, for his work on alternators and synchronous motors.

The *Central News* reports that Dr. Lobligeois, of Paris, has had to have an arm amputated consequent upon injuries due to the effect of radium. This is the fourth operation which the doctor has sustained from the same cause.

Mr. Robert Millar, electrician at Bowhill Colliery, Fife, received parting gifts at a recent social meeting at which Mr. John Kerr, head electrician at the colliery, presided. The presentation was made by Mr. T. Lister, of the electrical shop.

The *Sydney Morning Herald* states that the Sydney City Council at a recent meeting decided that the acting general manager of the electricity department (Mr. Maling) should be paid an allowance at the rate of £1,500 per annum additional to his present salary of £2,000 per annum. This allowance will be paid during the absence in London of the general manager of the department (Mr. Forbes Mackay). Mr. Mackay's fixed salary is £2,000 per annum, and he is paid an allowance at the rate of £1,500 per annum whilst absent from Sydney, in addition to travelling and other expenses. Reform aldermen objected to the allowance being paid to Mr. Maling in view of the fact that he was already being paid a salary equal to that of the general manager. The Labour party, on a party vote, decided that the allowance should be paid, and by a similar vote, defeated an amendment moved by Alderman Cole that Mr. Maling should receive an allowance of £1,000.

It is announced that Mr. W. M. Furniss, manager of the company's works at Wolverhampton, has been elected to the seat on the board of the Electric Construction Co., Ltd., rendered vacant by the death of Sir Henry C. Mance.

Obituary.—Mr. A. M. Conway.—It is reported in the Australian Press that Mr. Arthur M. Conway, chief electrical engineer for Orange, passed away in March at the age of 38 years. Mr. Conway, after training at the Sydney Technical College, went to America and held a position with the General Electric Co. of Schenectady. In the San Francisco earthquake he lost all his belongings, and after returning to Sydney he became, for a time, assistant general manager of the Australian General Electric Co., which position he resigned to take up his post at Orange.

Mr. T. Ferguson.—The death has occurred, at the age of 28 years, of Mr. Thomas Ferguson, an electrical engineer with the Sunderland Forge Co., at Birkenhead.

PROF. L. A. HERDT.—The *Engineer* records the death, which occurred on April 11th, of Prof. Louis Anthyme Herdt, Macdonald Professor of Electrical Engineering at McGill University. Prof. Herdt, who was born in France 53 years ago, is described as one of the leading electrical engineers of Canada, and one who had a part in many great electrical enterprises.

MR. M. KEATING.—The death occurred in London, on April 28th, of Mr. Maurice Keating, Superintendent of the Eastern Telegraph Co., Ltd., at Carcavelos Station, Portugal (late of Cahirciveen, Co. Kerry).

MR. H. BJERKE.—The *Anglo-Norwegian Trade Journal* records the death, last month, of Mr. Harald Bjerke, who was, until recently, director-general of the Norsk Hydro-Elektrisk Kvælstofaktieselskab. Prior to taking this position, Mr. Bjerke had been managing director of a number of industrial concerns in Norway.

Wills.—The late Sir THOMAS BROOKE-HITCHING, who was a director of the Chiswick Electric Supply Corporation, Ltd., and the West London and Provincial Electric Supply Co., Ltd., left £79,245 gross and £57,633 net personalty.

The late Mr. J. BROWNE MARTIN left £560,685 gross and £399,763 net personalty.

New Companies Registered.

Norton Wireless Co., Ltd. ((213,504).—Private company. Registered March 28th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers, importers and exporters of and wholesale and retail dealers in radio sets, &c. The subscribers (each with one share) are:—Jessie M. Kelly and T. Kelly, 13-14, Broadway, Deptford, S.E., radio dealers. The subscribers are to appoint the first directors. Qualification, 1 share. Remuneration, £100 each per annum. Solicitor: E. L. L. Foakes, 221, Bishopsgate, E.C.2.

C. A. C. Valve Distributing Co., Ltd. (213,497).—Private company. Registered April 28th. Capital, £100 in £1 shares. Objects: To carry on the business of electrical and motor engineers and contractors, suppliers of electricity, manufacturers, importers and exporters of and wholesale and retail dealers in railway and tramway appliances, telegraphic, telephonic, and radio apparatus, &c. The first directors are:—G. E. Ward, 10, Rangoon Street, E.C.3, managing director of a company; E. G. Brett, 10, Rangoon Street, E.C.3, secretary. Qualification, 1 share. Solicitors: Bateman & Co., 5, John Street, Bedford Row, W.C.1. Registered office: 10, Rangoon Street, E.C.3.

Sun Signs, Ltd. (213,460).—Private company. Registered April 26th. Capital, £1,000 in 500 10 per cent. cumulative preference shares of £1 each and 10,000 deferred shares of 1s. each. Objects: To acquire the whole or any part of the right, title, and interest in or appertaining to the provisionally protected invention comprised in or covered by provisional patent specification No. 22,936/1925, concerning "improvements in or relating to displayed signs," and to carry on the business of designers and manufacturers of and dealers in all kinds of signs, and displayed advertisements of all kinds, but more particularly in relation to the invention known as the "Sun-Sign" for affixing or applying to electric glow lamps or any other form of artificial lighting, &c. The directors are:—R. C. Spurin (permanent managing director), 12, Oakley Square, N.W.1; F. Hinde, 28, Adelaide Road, N.W.; C. Pedgrift, 12, Oakley Square, N.W.1. Qualification, 100 shares. Remuneration as fixed by the company. Registered office: 8, Red Lion Square, W.C.1.

Wico Electric Co. (F.2530).—Particulars of this company (incorporated outside the United Kingdom) were filed on April 22nd pursuant to Section 274 of the Companies (Consolidation) Act. The capital is $400,000 in $100 shares (2,000 shares preferred stock and 2,000 shares common stock). The company was incorporated in Massachusetts, U.S.A., on March 23rd, 1920, to manufacture and sell magnetos, storage batteries, electric ignition equipment, and electrical and mechanical specialities of all kinds. The British address is Chase Estates, Willesden Lane, North Acton, N.W.10. H. G. Brown, solicitor, of 2, Bond Court, Walbrook, E.C.4, is authorised to accept service of process and notices on behalf of the company. No list of directors has yet been filed.

Great Western Ignition Co., Ltd. (213,517).—Private company. Registered April 24th. Capital, £2,000 in £1 shares. Objects: To carry on the business of manufacturers and repairers of and dealers in electrical materials, goods and appliances, and also electrical and other automobile accessories and fittings, accumulators, batteries, dynamos, &c. The directors are:—R. C. Jackson, 32, Ashley Road, Bristol; A. R. Matthews, 7, Guinea Street, Redcliff Hill, Bristol. Qualification, 100 shares. Solicitors: Plummer, Parry & Patchett, 16, John Street, Bristol.

Norwich Wireless Co., Ltd. (213,526).—Private company. Registered April 29th. Capital, £1,000 in £1 shares. Objects: To carry on the business of radio engineers and manufacturers of and dealers in radio apparatus, consulting wireless experts, &c. The directors are:—S. Sacker and Mrs. S. Sacker, 19, Honeywood Road, Colchester.

Turkin, Ltd. (213,479).—Private company. Registered April 27th. Capital, £500 in £1 shares. Objects: To carry on the business of electricians, mechanical engineers and manufacturers and workers of and dealers in electricity, radio experts, &c. The subscribers are:—C. R. Turner, 2, Clowelly Gardens, Upper Tulse Hill, S.W., merchant; M. Moses, 119, Finsbury Pavement, E.C.2, solicitor's clerk. The first directors are not named. Solicitors: Cochrane & Cripwell, Balfour House, 119, Finsbury Pavement, E.C.2. Registered office: 32, West Street, Weston-super-Mare.

J. W. Peacock & Co. (1926), Ltd. (213,386).—Private company. Registered April 23rd. Capital, £500 in £1 shares. Objects: To acquire an electrical device known as "Walker's Patent Counter Sign," to adopt an agreement with J. W. Peacock and D. D. Walker, trading as "J. W. Peacock & Co.," and to carry on the business of manufacturers of and dealers in furniture, fancy and sports goods, jewellery, watches, clocks, chronometers, and optical and scientific instruments and appliances, electricians, &c. The permanent directors are:—E. R. Mountstephen, 797, London Road, Westcliff-on-Sea, ironmonger; J. W. Peacock, 26, Hamlet Road, Southend-on-Sea, furniture dealer; M. St. J. C. Shepherd, Eastwoodbury, Southend-on-Sea, electrical engineer; D. D. Walker, Ravensknowle, Springfield Drive, Westcliff, Southend-on-Sea, engineer. Qualification, £50. Remuneration, £100 per annum, divided between them. Secretary: J. W. Peacock. Solicitor: F. T. Fisher, 44, Alexandra Street, Southend-on-Sea.

Stanley Cox, Ltd. (213,425).—Private company. Registered April 24th. Capital, £1,200 in £1 shares (500 8 per cent., tax free, cumulative preference and 700 ordinary). Objects: To carry on the business now carried on by S. Cox at 30, Percy Street, Tottenham Court Road, W.C., and to carry on the business of manufacturers, commission agents, and merchants of electrical or other apparatus, &c. The directors are:—S. Cox (permanent managing director), "Ravensthorpe," Beltinge Road, Herne Bay, Kent, electro-medical engineer; R. H. Stevens, address not stated.

Official Returns of Electrical Companies.

Twiss Electric Transmission, Ltd.—R. H. Stevens, C.A., of 37, Walbrook, E.C.4, was appointed receiver and manager on April 19th, 1926, under powers contained in debenture dated September 28th, 1921.

Radio Equipment Co., Ltd. — C. Latham, of 78, New Oxford Street, W., was appointed receiver on April 22nd, under powers contained in debenture dated February 10th 1926.

Thornley & Co., Ltd.—Debenture dated April 19th, 1926, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Nettlefold & Sons, Ltd., 54, High Holborn, W.C.

India Rubber, Gutta-Percha and Telegraph Works Co., Ltd.—Particulars filed of £400,000 debentures authorised January 28th, and covered by trust deed dated March 29th, 1926, charged on certain properties at West Ham and Liverpool, and the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued. Trustees: J. S. Cockburn, Sir John Ferguson, K.B.E., Sir Henry C. Mance, C.I.E., and the Hon. S. E. Marsham.

Nelson Electric Co., Ltd.—Particulars filed of £1,000 debentures authorised March 26th, 1926, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £600.

Melbourne Electric Supply Co., Ltd.—Mortgage or charge executed out of the U.K., and comprising solely property situate outside the U.K., dated February 9th, 1926, to secure £100 and further moneys due to the sent and future including uncalled capital, the whole amount being now and future. Holder: Sir Alexander J. Peacock, K.C.M.G., Treasurer of the State of Victoria.

R. & T. Patents, Ltd.—A. A. Whittingham-Jones, of 41, Castle Street, Liverpool, ceased to act as receiver or manager on April 23rd, 1926.

Thornley & Co., Ltd.—Satisfaction in full on April 8th, 1926 of debenture dated April 12th, 1923, securing £500.

Lewis Thomas & Sons, Ltd.—Debenture dated April 1st, 1926, to secure £1,500, charged on the company's undertaking and property, including uncalled capital. Holder: J. D. Williams, Boulevard, North Parade, Aberystwyth.

W. Robson & Sons, Ltd.—First charge on the company's property, present and future, including uncalled capital, dated March 31st, 1926, to secure £900. Holder: T. W. Robson, 226, Westminster Road, Liverpool.

Neutron, Ltd.—Particulars filed of £1,300 debentures authorised April 12th, 1926, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £250.

Electric Fires, Ltd.—Mortgage dated April 8th, 1926, to secure £6,000, charged on certain properties, &c., in Norwich. Holder: Miss M. S. Reeve, 29, Thorpe Road, Norwich; and N. J. Adams, Stratton House, Cirencester.

"Ego" Engineering Co., Ltd.—W. A. J. Osborne, of Balfour House, Finsbury Pavement, E.C.2, accountant, ceased to act as receiver or manager on April 9th, 1926.

London Power Co., Ltd.—A trust deed dated April 15th, 1926, securing £3,000,000 5 per cent. redeemable debenture stock has been registered, constituting a floating charge on the undertaking, property, assets, and revenues of the company, present and future. The trustees are: The Law Debenture Corporation, Ltd., 24, Old Broad Street, E.C.2. The debenture stock was issued at a discount of 4 per cent.

Radio Communication Co., Ltd.—Mortgage or charge on the company's undertaking and property, present and future, including uncalled capital, dated April 14th, 1926, to secure £81,500. Holder: R. Sweeny, 20, Copthall Avenue, E.C.2.

Cooke & Whitfield Wireless, Ltd.—E. P. Q. Carter, of 33, Waterloo Street, Birmingham, C.A., was appointed receiver and manager by order of Court dated April 16th, 1926.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

Urban Electric Supply Co., Ltd.

The annual meeting was held on April 29th, Mr. P. D. Tuckett presiding. In moving the adoption of the report (*vide* our last issue, p. 711), the chairman said that it was eminently satisfactory. There was an 18 per cent. increase in the balance carried to net profit and loss account and a 26 per cent. increase in the net profit. Such a marked improvement in the Company's earning capacity was very gratifying; the shareholders had at last reached the stage of receiving a more adequate return on their investment and he hoped that they would be able to maintain it. The improved result had been brought about by the general expansion of the business and by a further reduction in the ratio of working expenses, the largest individual contribution coming from the Cornwall Power Company. The connections for the year showed a 6 per cent. increase and the output increased by 11 per cent., of which nearly two-thirds was attributable to the Cornwall Power Company. The outlook in Cornwall continued to improve, all the mines being actively engaged on extensive developments and looking forward confidently to the future if the price of tin remained at anything like its present figure, as it was considered likely to do for some years to come. To meet the growing load they were considering the extension of their power station at Hayle with the expectation of largely increasing its efficiency, and the stability and profit-earning capacity of the business. In

spite of the improved position which the balance sheet disclosed, he would not like them to infer that the reserves were in any degree over-adequate, with £100,000 of their capital sunk in unremunerative tramways, with their liability to write off the cost of their stations in the event of bulk supplies becoming available, and with the possibility of loss on purchase of their undertakings by the local authorities. Last year he had addressed the bulk of his remarks to the disquieting result of the inquiry which had recently been held into their prices at Stamford. They had since had another inquiry in connection with their Twickenham undertaking, the outcome of which had very much reassured them, for it had established the principle that they were entitled to earn the necessary minimum to enable them to form adequate reserves and provide a reasonable return on capital, whilst they on their part, in proof of their *bona-fides*, had undertaken to pass on to their consumers during the next three years any surplus profits over and above that necessary minimum. A number of substantial reductions had been made and further decreases were contemplated when they were in a position to make them. In view of the possibility of a general stoppage in the coal industry with all the disastrous consequences which it would have on the industries of the country, it was impossible to forecast at the moment what were their prospects for the present year. Apart, however, from any untoward development of that nature, they had no reason to anticipate anything but a period of steady and continuous progress; they had ample stocks of coal at all their stations. At the moment they were devoting their attention to the Government's Electricity (Supply) Bill now before Parliament in an endeavour to protect their interests. He did not propose to discuss its provisions in any detail, because many of them were so manifestly unfair and unworkable that they felt they were bound to be drastically amended in committee. With the avowed objects of the Bill, to cheapen electricity and stimulate its use, they were all in hearty accord, but with the proposed method of realising them they were most of them in entire disagreement, since they thought it was calculated to hamper existing undertakers by costly and unnecessary bureaucratic interference and to discourage private enterprise by impairing its ability to attract fresh capital. So far as their small undertakings were concerned, they would welcome the opportunity of availing themselves of cheap bulk supplies, provided that, in the event of their purchase by the local authority, they were not prejudiced by the shutting down of their stations. In their Twickenham and Cornwall areas they had already taken advantage of the bulk supply facilities available, but in most of their other isolated undertakings it was difficult to believe that for a good many years to come it would be commercially possible for any centralised organisation to afford them a cheaper supply than they could themselves generate locally owing to the excessive cost of transmission. Mr. Edmund Charrington seconded the motion and it was carried unanimously.

Johnson and Phillips, Ltd.

The company's annual meeting was held on April 29th. Mr. W. Claude Johnson (chairman), who presided, in moving the adoption of the report and accounts (*vide* our last issue, p. 710), said that the available balance was £152,134 The interest on the debenture stock was over £4,000 less than last year, largely owing to the reduction of the interest from 8 to 6 per cent. for the last six months of the year; the item would be reduced by about another £4,000 in the current year. The share capital had been increased from £500,000 to £600,000 by the issue of 100,000 new shares at 40s. per share on December 1st last. The premium of 20s. per share, amounting to £100,000, together with the premium of 2s. per share on the previous issue, amounting to £6,250, had been transferred to reserve account which with the £43,750 transferred from the profit and loss account, increased the reserve to £250,000. Over £63,000 had been spent on additions to the company's property. That was necessary in order to cope with the great increase in the amount of business which was continuing. Stock in trade and work in progress at about £479,800 and sundry debtors at just over £400,000, showed an increase of nearly £120,000, owing to the very large increase in the amount of business in hand at the end of the year, the profits from which would go to the benefit of the current year. It was fitting that the firm's jubilee year should have provided such record figures. The record turnover had been rendered possible by the greatly increased output capacity of the shops and the efficiency of the selling organisation. The extensions which they had carried out during the last two or three years had proved of inestimable value, enabling them not only to increase the turnover but to do so in a most efficient and economical manner, consistent with the maintenance of their high reputation for quality. The programme of extensions which they had in hand was well advanced. Attention had been paid to the question of selling and distributing the further increased output; the directors had always regarded productive capacity and selling capacity as contemporaneous—the one could not develop without the other. They had strengthened their sales and distribution organisation both at home and abroad. In conclusion, Mr. Johnson said that he was confident that the current year's results would be even better. Mr. J. McGregor (managing director), in seconding the motion, said that the work in all departments had increased, and there was every prospect of still greater business in the ensuing year. The Electricity Bill now before Parliament, if carried through successfully, would be of great national benefit. It would give the manufacturers of the whole country cheap power for production, lighting and transport, and, incidentally, it would bring the company large orders for most of its manufactures. Their finances would enable them to take full advantage of that increase in business, and they would be fully equipped with up-to-date machinery and working facilities, to deal with all requirements. The prospects were very bright and there appeared to be nothing to prevent their progressing, provided always that there was labour peace. During the last 21 years the capital had risen from £175,000 in ordinary shares with £175,000 of debentures, to £600,000 in ordinary shares with £300,000 of debentures, and the assets had risen from £362,832 to £1,376,934. The directors had been able to pay an interim dividend last year and they hoped to continue the practice. He believed that they would be able to increase the dividend next year.

Indo-European Telegraph Co., Ltd.

Presiding at the annual meeting on April 29th, the chairman (Mr. H. L. M. Tritton) said that the company's relations with the various Governments from which it enjoyed concessions remained satisfactory. He regretted that the Black Sea cable was still out of operation, but hoped that a way would soon be found out of the difficulties which surrounded that matter. Great strides had been made recently in cable communication, and there was ample room for that system of communication, as well as for land lines and radio-telegraphy. Mr. Tritton outlined the company's system, and said that it only transmitted messages directly; there was no delay at intermediate stations. They had a very efficient maintenance system which reduced interruptions to the minimum, and transmission errors were a very small proportion indeed in their large traffic. Dealing with the accounts, the chairman said that the expenditure on the reconstruction of the line in Russia and Poland, which was still in hand, showed an increase. That item and the one relating to the Persian section had been further reduced by sums set aside out of revenue. They had been able to maintain the dividend at 7 per cent., free of tax, and to increase the bonus from 1¼ to 3 per cent., free of tax.

Telephone Manufacturing Co., Ltd.

In a recent announcement, the directors point out that the company's bank loan, which has to be met by annual instalments of £40,000, together with the interest on the 8 per cent. income bonds, is a great strain upon the revenue, exceeding the total profit. Accordingly, a reorganisation scheme has been drawn up. Under this, the 410,000 issued shares of £1 each would each be divided into two 10s. shares, half of which would be retained by the present shareholders, while the other half would be issued to those who subscribe the additional capital which it is proposed to raise. In addition, the unissued shares (590,000) would be divided. A provisional agreement has been entered into with the Rock Investment Co., by which that company agrees to buy all the shares which would thus remain to be issued (1,590,000) for £590,000 in cash (less a commission of £88,500). By this means the company would obtain sufficient capital to pay off the 8 per cent. bonds and the bank loan, and £65,000 would remain as additional working capital. The arrangements with the Rock Investment Co. include an option to existing shareholders to purchase not fewer than 1,000,000 new shares at 7s. 6d. each.

By order of the High Court, a meeting of members will be held at Cannon Street Hotel, E.C., on May 12th, for the purpose of considering and, if thought fit, approving this scheme of arrangement proposed to be made. A copy of the scheme can be seen at the offices of the company, Hollingsworth Works, Martello Road, West Dulwich, S.E.

Swansea Improvement and Tramways Co., Ltd.

The meeting of this company, whose report was reviewed in our last issue (p. 711), was held on April 28th. Mr. C. G. Tegetmeier, who presided, said that the reduction in the revenue was disappointing in view of the facts that increased facilities had been provided and that the number of passengers had risen. The decrease was due to an increased proportion of workpeople carried. This heavily handicapped the company and it was impossible to reduce fares if they were to make proper provision for maintenance and renewals, and provide a reasonable return upon the capital. It had been said that motor 'buses had rendered tramways obsolete. That was certainly not the case in Swansea, where proper co-ordination had allowed an efficient tramway system to flourish side by side with an efficient omnibus undertaking. The Swansea Corporation had realised that unlimited competition in transport was not in the interest of efficiency or of advantage to the travelling public.

German Companies.

The directors of the *Hartmann and Braun Company*, Frankfort-on-Main, recommend a dividend at the rate of 5 per cent. for 1925, as in the previous year.

The *Emag Electricity Company*, Frankfort-on-Main, proposes to pay a dividend of 5 per cent. for 1925; there was a small loss in the preceding year.

The *Mix and Genest Telephone and Telegraph Works Company* proposes a dividend at the rate of 8 per cent. for 1925, as against 6 per cent.

The *Wolfram Lamp Company*, Augsburg, which is under the influence of the German Osram Company, reports net profits

of 62,000 marks for 1925, as compared with 50,000 marks in the previous year. It is intended to pay a dividend at the rate of 10 per cent., against 6 per cent.

The *German Cable Works Company*, Lichtenberg, Berlin, states that the business was removed from the old to the new works during 1925, the new copper rolling mill was completed, and additions were made to the machinery. After providing for depreciation the accounts show net profits of 376,000 marks, as against 395,000 marks in 1924, the dividend remaining at 6 per cent. The directors state that success attended the resumption of the export of cables, especially in the English market. The current year has so far been favourable.

French Companies.

The *North-South Electric Railway Company*, Paris, records net profits of 5,505,000 fr. for 1925, and is distributing a dividend at the rate of 12.76 fr. net per registered share and 10.44 fr. per bearer share. The City Council has asked the company whether it would be willing to transfer its undertaking before the pre-determined date. The company is said to be prepared to submit an acceptable scheme for the consideration of the shareholders.

The *Société Electro-Chimie, Electro-Metallurgie Ugines*, Paris, is increasing its capital from 80 to 120 million francs.

The *Compagnie Radio-Maritime* again proposes to pay a dividend at the rate of 22 fr. per share for 1925.

The *Compagnie Radio-Orient* intends to increase the rate of distribution from 4 per cent. to 6 per cent. for 1925.

Belgian Companies.

The *Société de la Fabrication des Câbles et Fils Electriques*, Brussels, reports a net profit of one million francs for the last financial year, as compared with 825,000 fr. in 1924.

The *Société Générale Belge d'Entreprises Electriques*, which is an investment company, reports an increase in the revenue from 7,390,000 fr. in 1924 to 8,853,000 fr. last year. The net profits were 4,783,000 fr., as against 3,502,000 fr. in 1924, and it is intended again to pay a dividend of 55 fr. gross on the old shares and 18.75 fr. on the shares issued during 1925. The directors express satisfaction with the progress made by the different undertakings, principally the works concerned with the supply of electricity.

Dutch Company.—*Philips Glowlamp Works.*—The Amsterdam correspondent of the *Financial Times* says that the gross earnings of this company during 1925 were 7,947,000 florins, as compared with 6,211,000 florins in 1924. After providing for depreciation, there is a balance of 4,000,000 florins, sufficient to pay 16 per cent. on the ordinary shares and 8 per cent. on the preferred. The extension reserve is increased from 7,414,000 to 9,410,000 florins.

Latin-American Company. — The *Compania Hispano-Americana de Electricidad*, Madrid, which a few years ago took over the electrical undertakings of the German Transmarine Electricity Company, reports gross profits of 72,457,000 pesetas for 1925, of which the sum of 34,079,000 pesetas has been applied to depreciation. It is proposed to pay a dividend at the rate of 14 per cent. as in 1924, although the share capital has been increased to 180,000,000 pesetas.

Madras Electric Tramways (1904), Ltd.—The directors' report for 1925 shows a gross profit of £35,190, and after meeting expenses and interest, and providing for depreciation and renewals, there remains a balance of £14,392, to which is added £7,124 brought forward, making £21,516. The preference and interim ordinary dividends absorbed £8,250, and it is proposed to pay a final dividend at the rate of 6 per cent. on the ordinary shares (making 6 per cent. for the year), to write £3,500 off the cost of the debenture issue, and to carry forward £7,516. The report says that a motor omnibus service was inaugurated during the year, and the tramway service is being accelerated. Although the cost of operating motor omnibuses is appreciably greater than the tramway expenses, the expenditure in Madras was reduced by 1.7 per cent. Meeting: May 11th.

Melbourne Electric Supply Co., Ltd.—The annual meeting was held in Melbourne in March. Mr. Agar Wynne, who presided, said that owing to the smaller amount of building which had been carried out in the city during the period under review there was a decline in the number of consumers connected; nevertheless the business was satisfactory. The results which had been obtained had justified the company's policy of keeping its distribution system well ahead of building developments in new areas. The valuation of the company's property was proceeding, and the directors hoped to be in a position soon to make a definite announcement of the exact purchase price which was to be agreed with the State Electricity Commission.

Pernambuco Tramways and Power Co., Ltd.—The report for the past year records net receipts of £170,270, as compared with £153,462 in 1924. After paying interest, &c., and putting £10,230 to capital reserve, £10,000 to reserve for contingencies, and £1,500 to the amortisation fund, the net profit is £35,515, as against £28,745. A dividend of 7 per cent. is to be paid on the preference shares. This is the first distribution since 1919, when 3½ per cent. was paid; £7,000 is transferred to general reserve; and a balance of £5,379 is to be carried forward. The number of passengers carried increased by six millions to 49,710,333, and the number of electricity consumers rose from 9,431 to 10,914.

Electrical Finance and Securities Co., Ltd.—After providing for debenture interest, office expenses, &c., amounting in all to £10,893, there remains a balance of £6,488 from 1925. To this is added £1,966 brought forward, making £8,454, out of which it is proposed to pay a dividend of 10 per cent., leaving £2,408 to be carried forward. The company is interested in the following undertakings, which all recorded progress:—The Northwood Electric Light and Power Co., Ltd.; the Foots Cray Electricity Supply Co., Ltd.; the Colne Valley Electric Supply Co., Ltd.; the Boston and District Electricity Supply Co., Ltd.; and the Lothians Electric Power Co. The report refers to the death of Mr. A. L. Radford, a director of the company since its inception. The meeting was to be held yesterday (Thursday).

Winnipeg Electric Railway Co.—The operating expenses declined and the gross earnings increased during 1925, raising the net income to $821,604. After allocating $374,050 to depreciation, a balance of $447,554 is carried forward to surplus account, making $1,042,343, and after paying dividends of 7 per cent. on the preferred stock and 2 per cent. on the common stock, there remains a balance of $612,343. The assets have been written down, and $73,100 has been transferred to bond sinking fund, leaving a balance of $380,287 to be carried forward.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

Northampton Electric Light and Power Co., Ltd.—70,000 new ordinary "B" shares of £1 each, fully paid, Nos. 342,123 to 342,369 and 350,001 to 419,733.

Northern General Transport Co., Ltd.—118,750 new ordinary shares of £1 each, issued at par, 2s. 6d. paid, Nos. 475,001 to 593,750.

Application have been made to the Committee to allow the following to be officially quoted:—

Calcutta Electric Supply Corporation, Ltd.—150,000 five per cent. cumulative preference shares of £1 each, fully paid, Nos. 2,375,001 to 2,525,000.

North Metropolitan Electric Power Supply Co.—300,020 six per cent. cumulative preference shares of £1 each, fully paid, Nos. 599,891 to 900,000.

Ever Ready Co. (Great Britain), Ltd.—The accounts for the year ended March 31st last show (subject to audit) a net profit of £140,000, as compared with £96,000 in 1924-25. It is proposed to transfer £49,800 to reserve (against £35,000) and to carry forward £23,800 after paying the following dividends:—5 per cent. on the preference shares, making 10 per cent. for the year; and 5 per cent., plus a bonus of 15 per cent., on both the old and new ordinary shares, making 25 per cent. for the year in the case of the old ordinary shares. Meeting: June 1st.

Bogota Telephone Co., Ltd.—By order of the High Court, meetings of the holders of preferential and deferred shares of the above company will be held on May 19th at Magnet House, Kingsway, W.C., for the purpose of considering and, if thought fit, approving a scheme of arrangement proposed to be made. Copies of the scheme of arrangement can be seen at the offices of the company, Magnet House, or at the office of Messrs. Wild, Collins & Crosse, Kenman's House, Crown Court, Cheapside, E.C.

National Electric Construction Co., Ltd.—Mr. G. H. Nisbett, presiding at the annual meeting on April 29th, said that the company's profit had increased and a dividend of 10 per cent. was being paid. The dividend equalisation and general reserves had been increased. While the outlook for the future was promising, he was apprehensive of the effect of the Government's Electricity Bill which, unless it was drastically modified, would inflict immediate and lasting injury upon the electricity supply industry.

Callender's Cable and Construction Co., Ltd.—The directors recommend a final dividend of 2s. per share on the old and new ordinary shares, making in the case of the old shares 3s. per share for the year.

They also propose to increase the authorised ordinary share capital from £700,000 to £1,000,000, and to capitalise £200,000 of the reserves and issue it in the form of £1 ordinary shares to present holders in the proportion of one to three.

Rothesay Tramways Co., Ltd.—The directors report a net profit of £4,454 for 1925. To this is added £1,171 brought forward, making £5,625, and after meeting debenture interest and allocating £1,707 to renewals, it is proposed to pay a dividend of 3 per cent. on the ordinary shares, to transfer £2,000 to reserve, and carry forward £672.

International General Electric Co.—The value of the orders received in 1925 was $25,710,000, as against $17,590,000 in the preceding year. The net income amounted to $2,641,063 and, after paying dividends and interest, a balance of $1,917,204 is added to the accumulated surplus, bringing it up to $11,860,270.

Bengal Telephone Corporation, Ltd.—The *Financial News* states that the report for the year ended June 30th, 1925, showed a net profit of Rs. 3,24,313. A dividend of 2 per cent. was declared on the ordinary shares and Rs. 30,137 was carried forward.

Richardsons, Westgarth & Co., Ltd.—A dividend of 3 per cent. has been declared on the ordinary shares, as compared with 5 per cent. for 1924.

Mirrlees, Bickerton & Day, Ltd.—Under the terms of the amalgamation scheme with the Mirrlees-Watson Co., Ltd., a payment of 2s. 6d. per ordinary share is being made.

Western Union Telegraph Co.—The gross operating revenue for 1925 increased by 12 per cent. to $127,078,023, and after adding other receipts and deducting expenses, interest, &c., including an appropriation of $1,000,000 for the development of ocean cables, a surplus of $15,186,259 remained. To this was added $56,980,028 accumulated surplus and $4,514,192 profit from sale of securities, making $76 680,479. From this were deducted a further $4,200,000 for ocean cable development, dividends totalling $7,232,457, and adjustments of surplus $279,911, leaving a surplus at December 31st, 1925, of $64,968,111. The report states that about one-third of the net income is now set aside annually for taxes.

City of Buenos Ayres Tramways (1904), Ltd.—A dividend of 1s. 3d. per share has been declared in respect of the quarter ended March 31st.

Burma Electric Supply Co., Ltd.—An interim dividend of 4 per cent. has been declared on the ordinary shares, as compared with 3 per cent. in 1925.

Stocks and Shares.

Monday Evening.

On the eve of what may, or may not be, a General Strike, it is only natural that Stock Exchange markets should be in an extremely sensitive state. Prices gave way in all departments. There was no trace of excitement or of panic. Brokers and jobbers found themselves with little to do, for the public did not come in with selling orders. Much of the decline in prices had no origin in sales; it came about as a measure of precaution lest people should want to turn out stock without there being any support to take what came on offer. Some prices became practically nominal; to buy shares was as difficult as it was to sell them. On this Monday evening, the markets separated with foreboding mingled with resignation. The principal complaint was that no newspapers had appeared since the middle of the day.

Falls in the Electricity Supply section are few and unimportant. The London group is steady. Amongst provincial shares, Newcastle-on-Tyne and Yorkshire Electrics are easier. In the manufacturing market, Johnson and Phillips have been changing hands up to £3, the increased dividend, making 17½ per cent. for the year, being attractive to investors. Electric Constructions are better at 31s. English Electrics, which touched 14s. 3d. on the passing of the dividend, are now up to 16s. 3d. Callender's preference have strengthened. The ordinary were unaffected in price by the announcement of a scrip bonus to be distributed from the company's reserves. It is proposed to capitalise £200,000 and to give to present proprietors one new share for every three shares held. The dividend is again 3s. per share, for the seventh successive year. The bonus forms a substantial present, and the expectation is not unjustified which hopes for a continuance of the 15 per cent. dividend upon the increased capital.

The Ever-Ready Company issued a remarkably good statement, net profits for last year being £44,000 higher than those of 1924. The company declares a dividend and bonus making 25 per cent. in all, against 15 per cent. in the previous twelve months. On this, the price of the shares jumped from 48s. 9d. to 56s. 3d., to react to 51s. 3d. in the malaise of Monday. At the latter price, the yield is over 10 per cent. on the money, allowing for the accrued dividend in the price.

Home Railway stocks are, of course, very flat. Metropolitans, Districts, and the Underground Electric Railways issues gave way sharply. In the last named, a somewhat extensive bull account had become built up during the past fortnight, the £10 and the shilling shares being a popular tip for capital appreciation. The temporary bulls hastened to snatch thin profits, for fear of a general strike, and the prices accordingly came down under the pressure of real selling. The London traction stocks have not changed. The L.C.C. anticipates a net deficiency of £192,500 upon its tramways for the year 1925-1926. Rearrangement of traffic conditions is the only lasting remedy which the L.C.C. Highways Committee can see for meeting the present lamentable state of affairs. National Omnibus shares have declined to 22s. 6d.

The Victoria Falls and Transvaal Power Company announces the starting-up of its new giant power station, 65 miles above Johannesburg. The new plant has a capacity of 20,000 kilowatts, and the company looks to multiply this by three when the whole of the section is completed. Mexican Utilities have strengthened, the gains ranging from 1 to 3 points, upon more cheerful news from the country. It is said, unofficially, that the Mexican Light and Power Company has a scheme under consideration for dealing with the arrears of interest upon its second mortgage bonds, and the unpaid dividends upon its preferred shares.

Automatic Telephones are 1/16 up to 2 7/16. Siemens new shares, 18s. paid, are quoted a little lower at 5s. premium. Babcock and Wilcox gave way to 49s. in sympathy with a general fall amongst iron, coal and steel shares. Radio Corporations had a jump of 15s. to 8½ on New York buying. The preference remained at 9¼. Cable stocks and shares show no variations on the week. A rise in rubber shares became checked by the strike crisis, but the statistical position of the rubber industry has taken a turn for the better, from the viewpoint of the holder of rubber shares, and the market would improve were there to be any public encouragement afforded to it.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom. £	Dividend. 1924	Dividend. 1925.	Price May 3 1926.	Rise or fall.	Yield. p.c.
Bournemouth and Poole	1	14	14	55/9 x all	—	4 16 0
Brompton Ordinary	1	10	10	18½	—	*6 8 1
Charing Cross Ordinary	1	15	15	44/6	—⅛	6 14 10
do. do. 4½ Pref. ...	1	4½	4½	17/-	—	5 5 11
Chelsea	1	12	12	2	—	6 0 0
City of London	1	15	15	48/9	—	6 11 2
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	27/-	—£d.	5 18 6
County of London	1	15	15	56/-	—	5 7 2
do. do. 6 % Pref.... ...	1	6	6	22/-	—	5 9 1
Edmundson's Ordinary	1	7	7	23/6	+£d.	5 19 2
do. 7% Pref.	1	6	7	22/-	—	6 7 3
Elec. Supply Corporation	1	10	10	32/6	—	6 3 0
Kensington Ordinary	5	15	15	18½	—	5 11 1
Lancs. Light and Power	1	7½	7½	26/-	—	5 11 1
London Electric	1	10	10	32/-	—	6 5 0
do. do. 6% Pref.	5	6	6	5½	—	5 11 7
Metropolitan	1	11	11	38/9	—	6 2 10
do. 4½% Pref.	1	4½	4½	17/-	—	5 5 11
Midland Counties	1	5½	6	20/-	—	6 0 0
Newcastle-on-Tyne Ordinary ...	1	7	7	21/8	- 9d.	6 11 9
do. 5% Pref. ...	1	5	5	18/-	—	5 11 1
do. 7% Pref. ...	1	7	7	24/-	—6d.	5 16 8
Notting Hill 6% Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6% Pref.... ...	1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	5	17½	17½	16¼	—	5 8 6
South London...	1	15	15	2¾	—	6 6 4
South Metropolitan Pref.	1	7	7	25/6	—	5 9 10
Urban Ordinary	1	4	4	22/6	+6d.	3 11 1
do. 6% Pref.	1	6	6	1	—	6 0 0
Westminster Ordinary	1	15	15	48/3	—	6 18 9
Whitehall Elec. Invst. 7½% Pref....	1	7½	7½	19/6	—6d.	7 13 10
Yorkshire Elec.	1	8	8	26/6	—1/-	6 0 9

Home Rails.

Central London Ord. Assented ...	Stock	4	4	68	—	5 17 8
Metropolitan	,,	5	5	64½	—2	7 15 0
do. District	,,	3½	3½	£11½	—½	6 16 0
Underground Electric Ordinary ...	10	Nil	Nil	3½	—⅛	Nil
do. do. "A" ...	1/-	Nil	Nil	10/-	—2/-	Nil
do. do. Income ...	Bonds	6	6	99	—1	*6 1 3

Telegraphs and Telephones.

		Dividend. 1923.	Dividend. 1924.			
Anglo-Am. Tel. Pref.	Stock	6	6	101	—	5 18 10
do. Def.	,,	1½	1½	23½	—	6 6 4
Automatic Telephone	1	3	6	2⅞	+⅛	4 2 1
Chili Telephone	5	5	5	6¼	—	*3 12 9
Cuba Sub. Ord.	10	5	5	6½	—	7 8 2
Eastern Extension	10	10	10	17½	—	*5 13 8
Eastern Tel. Ord.	Stock	10	10	175½	—	*5 14 0
Globe Tel. and T. Ord.	10	10	10	17½	—	*5 13 8
do. do. Pref.	10	6	6	10½	—	5 11 7
Great Northern Tel.	10	22	22	29	—	7 11 8
Indo-European	25	8½	10	47½	—	*3 5 3
Marconi...	1	10	10	1⅛	—	8 8 6
Marconi Marine	1	10	7½	18/9	—	8 0 0
Oriental Telephone Ord.	1	12	12	42/-	—	*5 14 3
United R. Plate Tel....	5	8	8	7¾	—	*5 1 7
Western Telegraph	10	10	10	17½	—	*5 15 11

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	8⅛	+6d.	8 19 6
do. do. 2nd Pref. ...	5	6	6	2½	—	11 3 4
do. do. 5% Deb. ...	Stock	5	5	73½	—	6 16 3
British Electric Traction Ord. ...	,,	6	6	127½	—	4 14 0
do. do. 6% Pref. ...	,,	6	6	107	—	5 12 2
Brazil Traction	100	4	4	93	+1½	5 7 6
Brit. Columbia Elec. Rly. Pcs. ...	Stock	5	5	85½	—	5 17 0
do. do. Preferred ...	,,	90/-	90/-	105½	—	*4 9 4
do. do. Deferred ...	,,	129/5	129/5	126	—	*5 3 2
do. do. Deb. ...	,,	4½	4½	75	—	5 13 4
London & Sub. Trac. 5% Pref. ...	1	2½	Nil	6/-	—	Nil
London United Tram. Deb. ...	Stock	4	4	48	—	8 6 8
Mexico Trams, 5% Bonds	—	5	5	63½	—½	7 17 6
Mexican Light Common	100	Nil	Nil	30½	+1	Nil
do. Pref.	100	Nil	Nil	75½	+3	Nil
do. 1st Bonds	—	5	5	70½	+1	7 1 10
Yorkshire (West Riding)	1	5	—	14/-	—	7 2 10

Manufacturing Companies.

Babcock & Wilcox	1	12	12	49/-	—	*5 6 1
British Aluminium Ord.	1	5	10	2⅛	+9d	4 17 0
British Elec. Transformer Pref. ...	1	Nil	7	18/9	—	7 9 4
British Insulated Ord.	1	15	15	9⅜	—	4 16 0
Brush Ord.	1	10	10	25/9	—	7 15 4
Callenders	1	15	15	3⅞	—	4 0 0
do. 6½% Pref....	1	6½	6½	2⅞	+1/8	5 9 5
Crompton Ord.	1	Nil	Nil	15/-	—	... ...
Edison-Swan	4/-	10	10	8/3	+6d.	4 17 0
do. 5% Deb.	Stock	5	5	89½	—¼	6 1 8
Electric Construction	1	10	10	31/-	+1/-	6 9 0
Enfield Cable, Pref.	1	7½	7½	1¼	—	6 0 0
English Electric	1	5	Nil	16/3	+6d.	6 7 0
do. do. Pref.	1	6	6	14/3	—	6 11 0
Gen. Elec. Pref.	1	6½	6½	23/-	—	5 13 1
,, Ord.	1	5	7½	29/-	+9d.	5 3 5
Henley	1	15	15	3⅜	—	4 5 4
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber...	1	5	5	22/6	—	*4 8 11
Johnson & Phillips	1	10	17½	2⅛	—	5 18 9
Met.-Vickers Ord.	1	8	8	29/-	—	6 19 2
do. Pref.	2	8	8	2⅜	—	6 14 9
Siemens Ord.	1	—	7½	20/6	—d.	4 18 4
Telegraph Construction	12	20	10	27½	—	*4 7 8

*Dividends paid free of Income Tax.

The Rugby Radio Station.

An All-British £400,000 High-power Telegraph Station.

By E. H. SHAUGHNESSY, O.B.E., M.I.E.E.

(*Abstract of Paper read before the* WIRELESS SECTION *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

(*Concluded from page* 719.)

Control Table.—The position of the control table can be seen from fig. 4. The slate panel contains all the essential controls and the most important meters of the wireless transmitter.

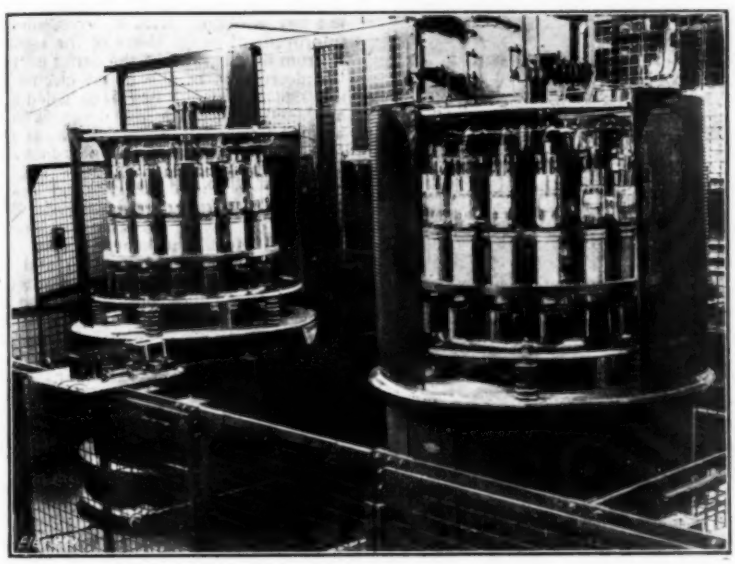

Fig. 10.—Third Stage of Amplification.

The apparatus terminating the land line from the Central Telegraph Office, London, which controls the transmission from the station, is fitted on the right-hand side of the panel, fig. 12, so that the duty engineer can check the signals passing through the transmitter and also speak to the controlling telegraph office as may be necessary. On the table on the left-hand side of the panel is an "engine-room telegraph" operated by push-buttons to enable the power requirements to be signalled to the power house. A loud-speaker and wireless recorder are provided for checking the actual signals transmitted from the aerial. In addition two press-buttons control a motor-driven variometer in the aerial circuit to compensate for any changes in the aerial constants due to weather, &c. The duty engineer, therefore, has full control of the entire station in detail from his position at the control table.

The high-frequency and other electrical measuring instruments fitted in the valve transmitting plant were supplied by Messrs. Everett, Edgcumbe & Co., Ltd.

Coupled Aerial Circuit.—Any large valve transmitter should be provided with a coupled circuit, since the use of a valve transmitter at reasonably high efficiencies necessitates the production of a certain proportion of harmonics which should be filtered from the aerial. For an "anode tap" the use of capacity rather than inductance brings with it a reduction of the harmonics in the aerial in the ratio of $1/m^2$ for the mth harmonic; that is, types B and D are m^2 times better than types A and C respectively, fig. 13.* For preliminary tuning, the use of capacity rather than inductance brings with it the disadvantage of having to be tapped in relatively big steps instead of being continuously variable as with an inductance; but, within these steps, variations of coupling between the primary circuit and the antenna circuit will produce equivalent changes in the adjustment of the complete circuit. Similar arguments apply to the method of coupling the primary circuit to the antenna circuit; that is, as regards the undesirable emission of harmonics, type E circuit is m^2 times better than type D, and therefore m^4 times better than type C. The ideal circuit, therefore, from the point of view of harmonic emissions is that shown as type E with capacitative coupling to both anode and aerial. In practice, however, it would be expensive to provide a range of condenser values for both anode and aerial couplings which would cover all the large and small adjustments required during the experimental period of tuning up the plant. If, however, a type D circuit is used with a condenser having a relatively coarse adjustment for the anode coupling and a continuously variable inductive coupling for the aerial, all necessary adjustments for the preliminary testing can be made with facility; then when the constants of the aerial circuit are known and the preliminary tuning has been completed, if necessary the change to type B can readily be made. It has, however, been found unnecessary to depart from the type D circuit installed.

The mica condensers, fig. 9, immersed in oil, were made by Messrs. Dubilier to meet the Post Office specification. They have a power factor of 0.00025 at the working frequency; the primary circuit is designed to carry 630 amperes, and at this current the value of the r.m.s. voltage applied to the condenser would be 33,000 volts (peak value 46,500 volts) and the kVA 20,800. Actually at present the value of the working primary current is about 300 amperes.

At the time the designs were being prepared the practical manufacturing limit as regards number of strands in a cable was 6,561 (=3⁸) and calculations indicated that the diameter of the coil should be great and the diameter of the wire used should be very small. It was, therefore, decided to use a cable of 6,561 strands of No. 36 S.W.G. wire for both the primary and aerial inductances, each strand being insulated by enamel and one covering of cotton or silk. The cables were made to the Post Office specification by Henley's Telegraph Works, Ltd.,* and Messrs. Connollys, Ltd. The maximum current-carrying capacity of this cable when wound into an inductance is probably of the order of 1,000 amperes. The cable is mounted on a framework of American whitewood,† wound in slots on movable wooden spiders which are supported by rollers on a wooden framework, so that changes

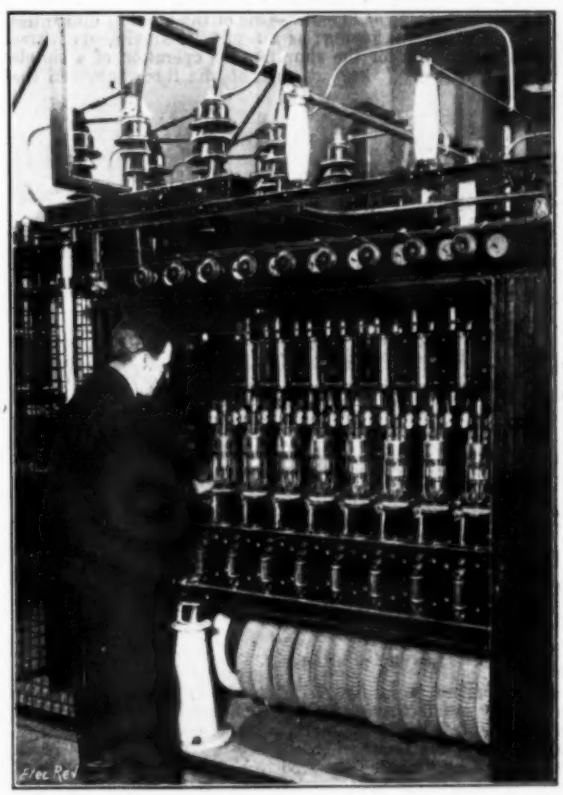

Fig 11.—One of the Power Valve Units (Gates open).

* Taken from a paper being prepared by Mr. R. V. Hansford and Mr. H. Faulkner for presentation to the Institution.

* See ELEC. REV., November 20th, 1925; p. 831.
† See ELEC. REV., July 10th, 1925; p. 61.

of inductance can be obtained by the relative movement of the spiders without the awkward mechanical construction of "tapping points" and the disadvantages of "overhanging" end-turns. The maximum width of the largest inductance coil is 14 ft. 6 in.

One outside spider can be moved by a screw in order to get a fine adjustment of tuning. The method of making a joint in the stranded wire between the spiders is to splay out the strands on a number of insulated flat copper plates and semi-conical copper fittings so as to ensure proper circulation of current through all the strands and to keep a cool joint.

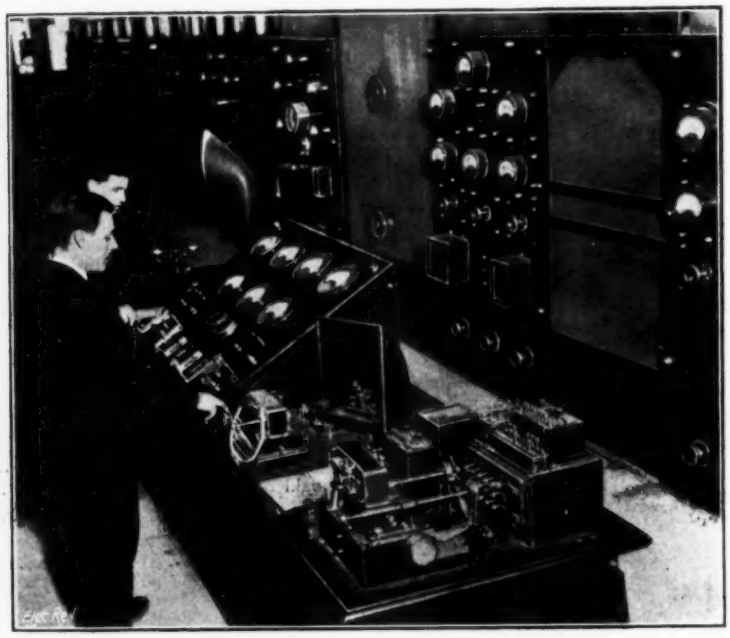

Fig. 12.—Telegraph Control Desk : Land-line Terminal on Right.

The actual measured resistance at 16,000 cycles of the entire primary circuit as erected was 0.088 ohm, giving a decrement of 0.0053. The measured resistance of the aerial tuning inductance and coupling coil (2,500 μH) at 16,000 cycles was 0.11 ohm, giving a decrement of 0.00137 for the coils, and the author has not noticed details of any transmitting inductance which is as efficient as these have proved to be.

Keying and Shape of Signals.—One of the greatest difficulties is that of successful keying; as a result of experiments it was decided to provide for the simultaneous operation of a simple "make and break" key at each of the three points in the

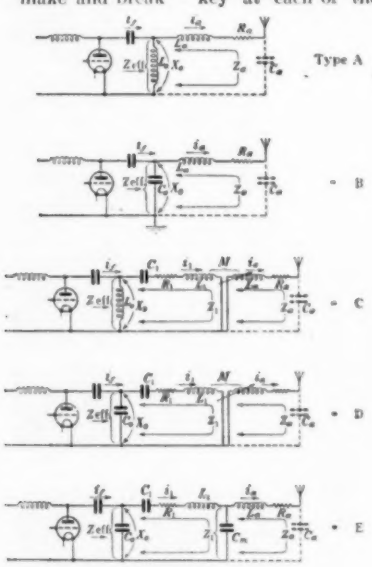

Fig. 13.—Types of Output Circuits.

circuit marked x in fig. 7. The system has proved to be eminently satisfactory and Creed pneumatic keys are used at points *a* and *b* and a magnetic relay at point c. There is no oscillation in the aerial when the key is "up" and this result is obtained by breaking the feed to the grid from one stage of amplification to the next, as shown in fig. 15, which is a skeleton diagram of the last inter-stage circuit. Two points of particular interest in the arrangement are, first, that the key splits the coupling condenser to the grid and leaves the condenser B between the grid and filament when the key is up; this condenser is of sufficient value to make the impedance from grid to filament capacitative, and this counteracts any tendency that this stage may have to self-oscillate. The second point of interest is the series circuit A B C from grid to filament; A is merely a high-frequency choke, B is an adjustable resistance (grid leak) and C is a d.c. (grid bias) generator. When the key is down the mean negative grid potential is the sum of that due to the grid leak and the generator; when the key is "up" the only bias is that due to the generator. By adjusting the proportions of the bias due to grid leak and generator respectively when oscillating, it can be arranged that the generator voltage is sufficient to allow a suitable d.c. current to pass through the valves when the key is up. The advantages of this are that (1) the d.c. load with "key up" reduces the voltage "kick" on the generator with keying, and (2) the conductive path through the valve (due to the small grid bias) increases the damping of the aerial when the key is "up," with a corresponding improvement in the shape of the signals.

From oscillograms of the aerial current the decrement of the aerial circuit for the rise of current has been calculated as 0.0086, whilst for the decay it is as high as 0.024; for higher speeds, advantage will be taken of the quick decay by decreasing the length of the "space" relatively to the "mark" and means for doing this are being developed. This method of keying is due to Messrs. Hansford and Faulkner, whilst the whole of the work of erecting and assembling the internal wireless plant was done by Post Office workmen under the supervision of, and to the detailed designs of, Post Office engineers. The tuning-fork units were made in the Post Office experimental workshop at Dollis Hill.

Masts.—The masts are 820 ft. in height from ground-level to the top of the antennæ aerial sheave and are of the stayed and pivoted type. The pivot is about 17 ft. above ground-level; below this are columns of porcelain insulators and a granite cube (5 ft. 6 in. sides), the whole being supported by a steel columr The total weight of steelwork in a mast is 170 tons and the weight of the 15 stays is 28 tons, and stay anchorages, &c., 12 tons. Under maximum wind load the resultant vertical load on the base of the mast is 400 tons.

The insulation is primarily provided by 12 columns of porcelain insulators arranged three in each column between steel castings immediately below the pivoted joint. The insulators will withstand a high-frequency voltage of 25,000 (r.m.s.) at 50,000 cycles per sec. for 6 hours without overheating or breaking, having first been immersed in water for 2 hours. They were tested mechanically to a compression load of 270 tons;

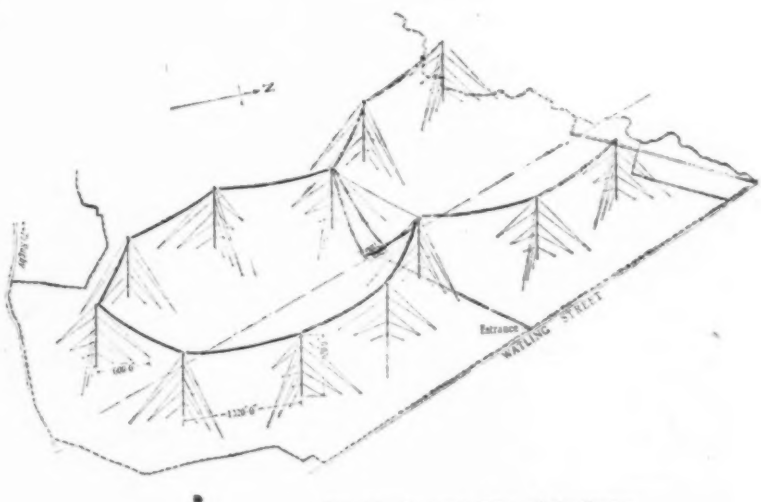

Fig. 14.—Isometric View of the Station.

each is 9 in. in diameter and 3½ in. thick, with a recessed hole in each face 2½ in. dia. and 1 in. deep.* Their arrangement permits of the insertion of 3 hydraulic jacks to raise the mast and replace faulty insulators as required.

The stays are insulated at the base only, and a hydraulic press is incorporated in the stay-rope attachment which can be used to measure directly the tension of the stay.

The stays are of parallel strand construction and were made

* See ELEC. REV., July 10th, 1925; p. 60.

on the site. The larger is composed of 151 wires of No. 10 S.W.G., having an area of 1.918 sq. in. and a circumference of 5½ in., and this type of stay has a great advantage over the usual small wire stranded variety in possessing a smaller extension under load.

The masts were manufactured and erected by Messrs. Head Wrightson and Co., and switches are provided for earthing the masts when access to them is required and also for enabling transmission to be carried out at full power with the masts earthed. A spark-gap is also associated with the switch as a protective device against abnormal voltages on the masts or aerial.

Aerial System.—Two separate aerials of different capacities may be used, or the two combined to form one larger aerial

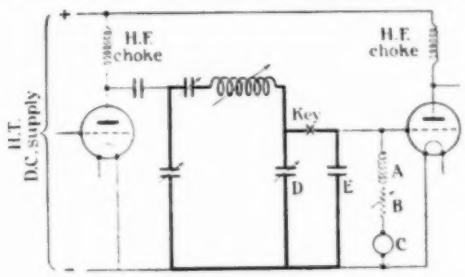

Fig. 15.—Inter-stage Circuit.

(fig. 14). The larger of the two is the telegraph aerial and forms an elongated octagonal figure in plan, with sides of 1,320 ft., but with opposite sides on axes at right angles at distances apart of 880 and 1,200 yards. The smaller aerial open arms arrangement is designed to permit of the addition of four more masts if necessary. The aerial insulators are of the porcelain-rod tension type, weighing 6½ cwt. and each will withstand a pull of over 20 tons and 200,000 volts at 50,000 cycles per second across the ends without damage. They were made by Messrs. Bullers, Ltd. Spider spreaders of tubular steel, 12 ft. in diameter and spaced 140 ft. apart, support the eight 7/14 S.W.G. silicon-bronze wires that form the cage aerial. The split hubs of each spreader are tightly clamped to a central steel supporting cable. The tension of the lead-up wires is taken by 6 porcelain tubes, similar to those used in the main aerial insulators, suspended on a steel structure near to the building, fig. 16, the steel rope supporting the aerial insulators passes down the centre of the mast and is attached to a drum fitted with a slipping friction brake so adjusted that the rope is slackened when the load exceeds 10 tons.

The earth system on the telegraph site consists of copper wire, 100 lb. per mile, buried a few inches below ground, and follows the plain of the aerial and extends 800 ft. on either side. Near the buildings the wires leave the ground and converge upon the transmitting room in a fan arrangement (fig. 17).

An insulated counterpoise has been erected under the smaller aerial at an average distance of about 16 ft. from the ground, following generally the earth system in arrangement.* The ratio of the effective height of the aerial with the masts earthed is 1.22. At 19,000 m. wave-length the aerial resistance with masts insulated is 0.7 ohm, and with the masts earthed it is 0.55 ohm. The use of inefficient insulators for masts practically doubles the aerial resistance, *i.e.*, when the porcelain insulators are short-circuited and the granite blocks alone are used as insulators.

The resistance of the blocks steadily rises as the granite slowly dries out. The effect of the dielectric current in the granite is to drive out moisture gradually from the interior; this action, combined with absorption by the atmosphere in the spring and summer, will raise the insulation to a maximum value, and the granite blocks will then be completely coated with a bitumastic solution to retain them in a dry state.

Results Obtained.—Below are two typical series of measured values of the more important quantities when working on one portion of the aerial only, *viz.*, that having a capacity of 0.33 μF.

Number of power units in use ...		3	3
Total number of valves in power units		54	54
Aerial circuit	Current	550 amps.	600 amps.
	Power	257 kW.	306 kW.
Primary circuit current		275 amps.	300 amps.
Coefficient of coupling to aerial ...		0·015	0·015
Efficiency of coupled circuit ...		97½%	97½%
D.C. input	Voltage	5,820 volts.	6,780 volts.
	Current	61 amps.	64 amps.
	Power	355 kW.	434 kW.
Filament power		48 kW.	48 kW.
Efficiency of transmitter	Excluding filament	72%	71%
	Including filament	64%	64%
Voltage on antenna		165,000 volts.	180,000 volts.

The above figures are for about two-thirds power of the station, and the present limitation is the fact that only a portion of the main aerial is available, which is already being used at antenna voltages in excess of 165,000 volts. With this power, however, the station has been proved to have a world-wide range and only the collection and scrutiny of data over a long period will show to what extent, if any, an increase of power is necessary for a *continuous* world-wide service. From the experience already gained it can be predicted that, if it is proved to be necessary, 3-power units using a d.c. supply of about 9,000 volts will give an antenna current of the order of 750 amperes in the larger antenna of 0.045 μF, with an increased overall efficiency.

During the several months that the station has now been testing and working commercially with type D circuit, not a single complaint has been received with regard to interference with broadcast or other reception by harmonics from the telegraph transmissions.

Experimental Telephony.—The experimental telephony installation works with the smaller aerial, and the American Telephone and Telegraph Co.'s "single-side band" system described by the late Dr. H. W. Nichols.* The modulating and filtering circuits and the valve amplifying panels were made and installed by the Western Electric Co., Ltd., in co-operation with the American Telephone and Telegraph Co.

Experimental tests show that good speech is received in New York during most hours of the day when using an aerial current of about 185 amperes. This installation may form the subject of a separate paper when reliable data has been collected over the period of bad atmospheric conditions. In addition, two other installations to work with smaller aerials supported on the existing masts are being provided. One will be a medium-wave 50-kW valve set and the other a short-wave 15-kW valve set.

Discussion in London.

Mr. L. B. TURNER presided and opened the discussion by reading a communication from Dr. W. H. ECCLES, who commended the excellent team work of the Post Office engineering staff; they had been responsible for the design and development of unusual forms of plant and circuits and the best testimonial to their work was the station's magnificent performance. Its erection had been completed without failure, fault, or accident, and the estimates were very close to the final expenditure.

SIR GUY WRIGHTSON, of Messrs. Head, Wrightson & Co., who supplied and erected the masts (which have formed the subject of an Institution of Civil Engineers' paper) said that their erection had been carried out in one of the wettest and windiest seasons that he remembered without accident.

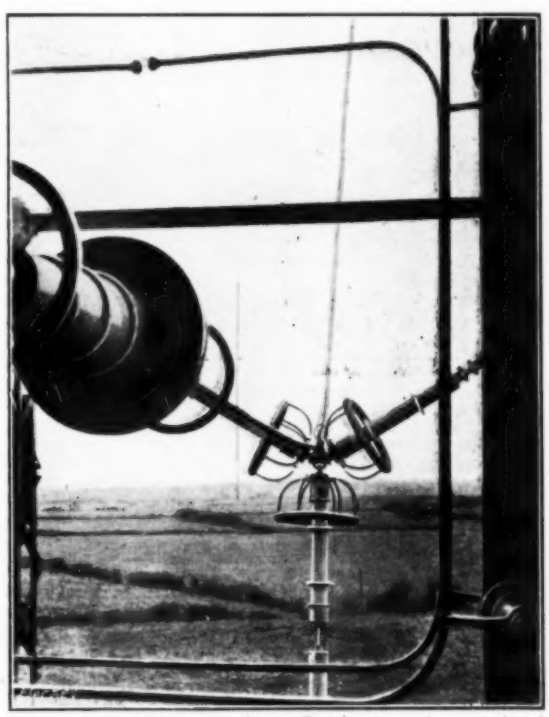

Fig. 16.—Aerial Lead-in.

Mr. C. ELWELL wanted to know whether it was necessary to provide so many masts. No engineering difficulty would be encountered in erecting even higher masts than those at Rugby, nor in providing for a much greater aerial pull, say, 30 tons, in which case the masts could be double the distance apart. With regard to valves, personally, he favoured the use of a smaller number of larger size, because the maintenance factor of many small ones was unknown. Large valves could have their filaments renewed.

Capt. P. P. ECKERSLEY envied the Post Office engineers' ability to erect a station of that size wherever they liked without the consent of anybody, but his envy was changed to admiration when it was realised that the telegraphic plant operated without seriously interfering with the broadcast wave-

*The counterpoise has since been buried.—EDS.

Journal, I.E.E., 1923, vol. 61, p. 812.

band; telephony was another matter. He congratulated those concerned on having built the station on a solid engineering bases, and admired the manner in which the Meissner patent had been overcome. The application of a tuning fork represented a unique advance in methods of maintaining wavelength constancy; the British Broadcasting Co. had experimented in that direction and had used tuning forks for independent drives; starting with 890 cycles it had been possible to drive a relay station at a frequency of nearly one million cycles. Many valves made for safety, but would it not have been more economical to have used less expensive mast insulation and a little more power?

Mr. H. N. VIVIAN felt that the Rugby station was the last word in two respects; it was the best of its type ever built and he believed it would be the last. In a short time the "beam" stations would prove whether that opinion was sound or not.

Mr. E. H. SHAUGHNESSY, in reply, remarked that the long-wave stations in Germany and France were still doing very well and there was no indication that they would be scrapped. The Post Office knew something about short waves, including the fact that they did not behave the same from day to day and a telegraph service was of little value if it were not reliable. If manufacturers would not repair large valves, the Post Office would have to do it.

Radio Measuring Instruments.

However casually the average engineer may be inclined to regard "wireless," contemplation of the Rugby station can hardly fail to arouse enthusiasm for the achievements of the radio engineer, and especially is the General Post Office staff to be congratulated on having built a station costing about £400,000 and containing only £1,000 worth of foreign apparatus. Even the heaviest of heavy-current engineers must be impressed by the provision of 1,000-ampere radio ammeters with which to measure the flow of the high-frequency current to the oscillatory system. The electrical measuring instruments for the valve transmitting plant were supplied by Messrs. Everett, Edgcumbe & Co., Ltd., and a brief survey of the more interesting types employed may not be without interest as indicating the care that has been taken to meter the energy needed to operate the station. The switchboards controlling the supplies of a.c. at 100 cycles for filament lighting, and the high-voltage d.c. for the anodes, in addition to the low-pressure d.c. for various auxiliary purposes, are equipped with "Superscale" instruments.

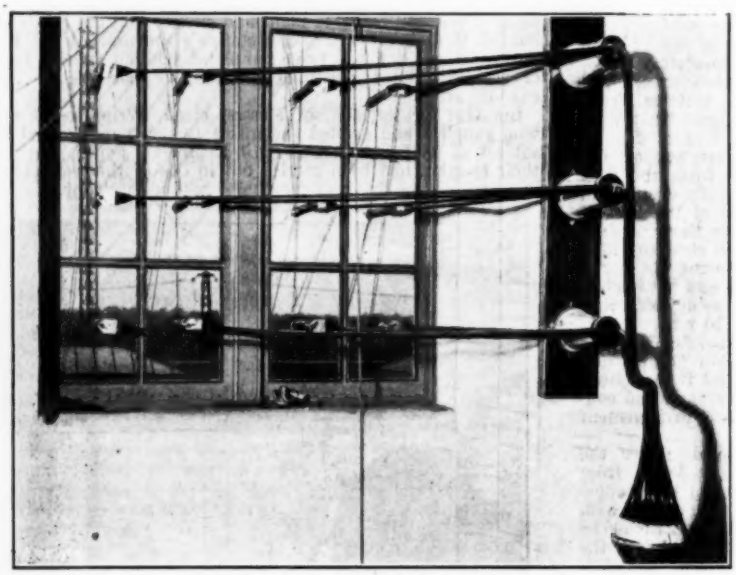

Fig. 17.—One of the Earth Leads-in.

An interesting feature is the mounting of a specially designed electrostatic voltmeter on each pair of motor-driven main generators; each instrument is mounted on an insulating pillar on the top of its machine, and is calibrated, with both poles insulated, to read the total voltage of each pair of generators, *i.e.*, 6,000 volts. When the generators are in series a specially developed tank type of voltmeter is used for measuring the full anode voltage of 18,000 volts. It consists of a "Superscale" milliammeter of the moving-coil pattern connected in series with a high resistance contained in an oil-filled porcelain tank, and arranged to pass milliamps. per thousand volts across the terminals, the milliammeter being calibrated in kilo-volts to correspond. The resistance tank is placed high up in a place of safety, since it necessarily has the full potential across it and the instrument may be seen in the centre of the bottom row on the control desk (fig. 12). The filament current of the valves is continuously recorded on "Inkwell" ammeters; the total valve hours worked by each bank can thus be readily ascertained by integrating the chart readings and information as to constancy of supply is easily obtainable. In addition to the cooling-water flow-meter, d.c. "Superscale" instruments indicate the grid and anode filament currents and a third ammeter (designed to carry both d.c. and a.c.) indicates the oscillatory component of the anode filament current. The last-mentioned instrument, a considerable number of which pattern is in use in the station, is worthy of description: The indicating portion of the instrument consists of a thermal-expansion ammeter designed to ensure accuracy at any frequency. An important factor in this respect is the actual current passed through the indicator, and being transformer operated, the latter can be adjusted to work with any current value considered desirable. A figure of 2 amperes was chosen to allow the use of a working element sufficiently thin to be negligibly affected by skin effect, even up to several million cycles per second, and yet sufficiently robust. A current of 2 amperes, further, is sufficiently large to render any parasitic currents induced in the connecting leads negligibly small by comparison. Another consideration is the importance of avoiding the formation of an inductive loop of any size, by the disposition of the internal wiring and terminals; this possible source of error has been avoided by the use of tubular concentric terminals which project from the back of the instrument, and to which the connecting leads from the transformer secondary are joined. The latter are constructed of separately enamelled copper flex, similar to that used in the tuning inductances of the station, the twin insulated conductors being parallel to one another in an external braided covering; both the impedance and the tendency to collect induced parasitic currents are less with this arrangement than with the more usual type of twisted lead. At Rugby, the radio-current transformers are connected directly between the various sections of the oscillatory circuits, the instruments themselves being placed on the control panels and main control desk, sometimes as much as 80 ft. away from their respective transformers. The advantages of this method of measuring large high-frequency currents, as compared with the usual type of directly connected thermal instruments, can readily be appreciated and the transformers themselves have a transformation accuracy well within 0.5 per cent.; although they involve the use of iron cores, thereby greatly reducing their bulk, they have been supplied to work in circuits operating at frequencies as high as 5,000,000 cycles per second. The cores are built up of thin laminated silicon steel, overwound with the secondary winding, the size of wire being so chosen that the required turns exactly fill either one, two, or three complete layers. No gap or uneven winding is permissible, since any variation of the secondary linkage will inevitably cause local leakage of magnetic flux, and thus local heating of the iron. At the higher radio frequencies, even a dozen stray lines will cause sufficient heating of the iron to damage the insulation, the normal working flux density, in such a case, ranging from 0.5 down to 5 gauss at the lower frequencies.

The core and secondary winding (which is of toroidal form, to secure immunity from stray fields) are housed inside the primary winding, which consists of a spun-brass or copper sheath, thus further protecting the secondary from the effect of external fields. The primary current enters by a tubular conductor, passing through the centre of the wound core; it then returns, first, by way of the copper sheath, flowing radially in all directions, and finally through a second tubular conductor, concentric with the first; the whole, in fact, corresponding with a "one turn" current transformer. At high frequencies, however, the use of the iron core makes one turn adequate for currents as low as 10 amperes, such a transformer being only a few inches in diameter and weighing under 1 lb., whilst a 1,000-ampere transformer weighs about 10 lb.

A number of transformer-operated instruments may be seen both on the panels in the valve room, and in the top row of the main control desk (figs. 4 and 12), the capacity of the latter instruments being from 500 to 1,000 amperes of radio-frequency current.

Another instrument of an unusual nature is installed close to the main control desk. It is an electrostatic voltmeter of the attracted-disk pattern, adapted for use as a peak voltmeter; by comparing this reading with the r.m.s. voltage, some idea of the crest factor can be obtained. The peak voltage is measured by connecting a highly insulated condenser in series with a two-electrode valve across the lines. Owing to the non-return action of the valve, the condenser becomes charged to a pressure equal to the maximum value impressed on it, *i.e.*, the peak of the pressure wave. This voltage across the condenser is measured by the electrostatic voltmeter, which thus indicates the peak voltage. An important proviso is that the leakage across the voltmeter and condenser must be very small. It is, of course, the peak of the wave which tends to leak away, and a leakage amounting to, say, 0.2 per cent. of the half wave would represent about 2 per cent. off the peak. Long porcelain supports are used for this voltmeter which has ranges of 10, 20 and 40 kV.

In conclusion, our indebtedness to Mr. F. E. J. Ockenden, who made a special study of the problems involved, for the above details must be recorded.

A Steam-Electric Cotton Mill.

The Rishton Victoria Spinning Co.'s Modernised Plant.

THE ceremonious inauguration of the modernised cotton mill of the Rishton Victoria Spinning Co., Ltd., near Blackburn, took place recently. The installation is of an interesting kind, consisting of a steam turbine driving the spinning mill direct by ropes and the weaving shed electrically; it has been specially designed so that the stopping and re-starting operations at meal times can be effected in the shortest time without difficulty.

It is believed to be the first plant of its type to be commissioned in that district and is an example of what can be done to bring the power plant of old mills up to date in order to meet modern conditions, without having to shut down the mill for a long period.

The original plant consisted of a double beam engine of 900 i.h.p., built in 1860, which drove the spinning mill by spur gearing and an upright shaft; also a horizontal engine for driving the weaving shed through bevel gears. Various schemes for conversion to modern driving were considered, including reciprocating engines and electric driving, but eventually it was decided to install a geared steam turbine and condensing plant with combined rope and electric drive, as shown in fig. 1, the order for the plant being placed with Messrs. W. H. Allen, Sons & Co., Ltd., of Bedford. An important factor was the necessity of keeping the machinery running during the changeover; this was effected by, first, installing the turbine and rope pulley in a small space between the mill chimney and the mill and alongside the existing beam engine house, and the spinning portion of the mill was driven by ropes from the turbine.

The old beam engine and upright shaft were then dismantled and the alternator for driving the weaving shed was erected and coupled to the turbine. Motors were installed in the

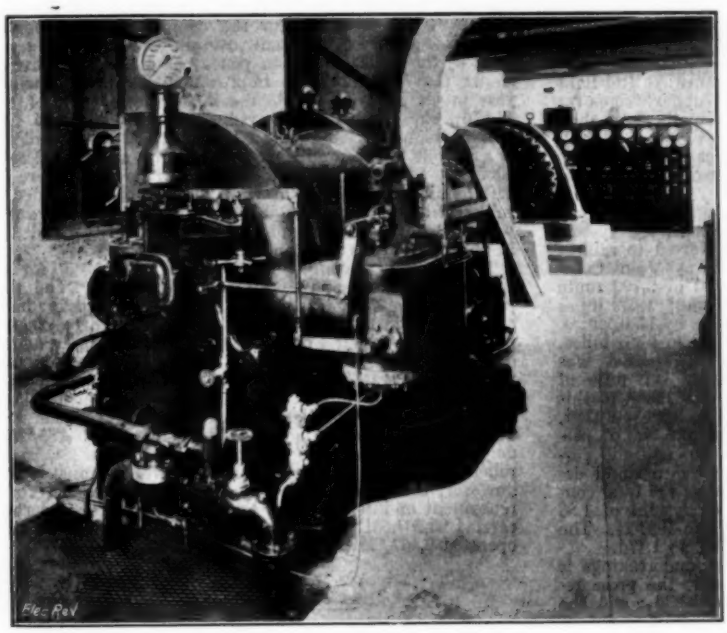

Fig. 1.—Cotton-Mill Steam-Electric Plant.

weaving shed, commencing at the far end, one motor driving three cross shafts, the reduction in speed being effected by double helical wheels. When the last cross shaft was coupled up, the old weaving-shed engine was dismantled. The plant drives 40,000 spindles direct by ropes and the electric motors drive 852 narrow looms and 268 sheet looms; an unusual feature of the drive is that the motors have been arranged to start with the alternator, thus eliminating individual starting and loss of time as referred to above. The alternator and motors were supplied by the Electric Construction Co., Ltd., of Wolverhampton, and the wiring was carried out by Messrs. Adams and Co., of Manchester.

Provision has been made for the turbine to drive an additional load, if required for future extension, the total available power being 1,750 b.h.p. The boiler pressure is 160 lb. per sq. inch with steam superheated to 65 deg. F. The turbine runs at 4,800 r.p.m. and is geared down to 500 revolutions, while provision has been made for a portion of the steam to be utilised for heating purposes after it has developed power in the turbine. The exhaust steam from the condenser air pump is utilised for heating the boiler feed water before it enters the economisers. Arrangements have been made to enable the turbine to start quickly under vacuum; it requires only two minutes to attain full speed. Apart from the increase in production that the new plant yields, the cost consumption is much lower than that of the old plant.

In conclusion, we are indebted to Messrs. W. H. Allen, Sons and Co., Ltd., for placing the above particulars at our disposal.

A Meter-Testing Laboratory.

A Visit to the Outside Department's Premises of the North Metropolitan Electric Power Supply Co.

ON Thursday of last week Sir James Devonshire, K.B.E., the chairman and managing director of the North Metropolitan Electric Power Supply Co., received and welcomed a number of engineering representatives of manufacturers and other electricity supply undertakings at an inspection of the premises of the outside department of the company at New Southgate.

The company carries out with direct labour the whole of the necessary underground extensions to its super-extra-high, high and low-pressure systems, requiring the laying of some two hundred miles of cable per annum. The work is carried out under the supervision of a mains superintendent and an assistant engineer, and a permanent staff of 37 men, including three foremen, 10 jointers and jointers' mates, and 14 labourers. Owing to the extensive area in which the company operates, it is not practicable to carry a larger staff of permanent labourers, but an average of 200 casual labourers are employed, these being drawn, as far as is possible, from the districts in which extensions are carried out. A fleet of five motor lorries and a 12-ton six-wheel cable carriage provide for the transport of materials for the four gangs normally employed.

The maintenance of the super and extra-high-pressure mains is carried out by the permanent staff of the mains department, the maintenance of the overhead lines being dealt with by a linesman and a mate. The pressure testing of the low- and high-pressure mains is carried out by means of suitable portable step-up transformers. The super- and extra-high-pressure mains are tested by means of a portable 2-tube Kenotron apparatus, made by Messrs. Watson & Sons, and designed for a maximum pressure of 200 kV. The recording of all the mains extensions is carried out in the outside department drawing office, a senior and four junior draughtsmen being employed on this work.

The department was formed in 1921 to control the stores, mains and meter departments of the company, the accommodation consisting of a three-storey private house (No. 15, Friern Barnet Road). The rapid increase in the company's activities had rendered the original accommodation inadequate, and separate buildings have been erected at the rear of the house, which now provides office accommodation only for the stores and mains departments.

All materials required by the company's district undertakings are stocked in a two-storey building, 72 ft. by 33 ft. A third but independent floor above this building accommodates the central offices, where the accounts for the whole of the company's consumers, about 24,000, are dealt with. The feature of the premises, at least from the technical point of view, is the meter department's building which has recently been erected. This consists of a single-storey building divided into four sections, receipt and dispatch room, workshop, testing laboratory, battery and motor generator room. Immediately on delivery all meters are permanently marked with a serial number in the first-mentioned portion, to which they are returned after being dealt with in the laboratory. The workshop contains the necessary bench accommodation and apparatus for the complete overhaul of all types of meters, separate benches being devoted to each type. The battery and motor-generator room contains a 4-cell 800-Ah Tudor battery and a 3-unit motor generator, consisting of a 2½-h.p., 3-phase motor driving a 600-V, 1-A, d.c. generator and one of 10-V, 100-A rating.

The laboratory is perhaps the reverse of what has been conceived as the up-to-date test room, and its conspicuousness lies in the absence of complicated and elaborate instruments. Those responsible for the lay-out of the department have obviously gone out for simplicity throughout—and with it efficiency. Methods of testing have been adopted which ensure, without loss of accuracy, the necessary speed to cope with over 10,000 meters per annum. If permissible, the term "testing by mass production," might be applied. The bulk of the meters are tested against rotating sub-standard meters which, with other standard and sub-standard instruments, are accommodated on a separate standards bench. Test racks and benches for dealing with the different types of meters are placed in the usual manner throughout the room, and all connections between the benches and racks are run in ducts below the floor.

Two methods of testing single-phase Wh meters are employed, one, in which a tapping key controls both the current and potential of the testing circuit and the standard meter, is allowed to rotate x revolutions; the angular displacement from zero of each test meter disc is then read on a gauge, which gives direct readings of the percentage inaccuracy. In the second method the tapping key controls the sub-standard meter only; this is run during x revolutions of each meter under test,

the percentage error being calculated from the sub-standard disk reading. The polyphase meters are tested against a standard double-element dynamometer-type wattmeter. Other types of meters are tested by modifications of the usual testing methods.

For collecting data concerning different types and makes of meters, samples are tested at various temperatures in a small electrically-heated oven with a glass front and suitable terminal arrangements. This oven is also used for the desiccation of transformer oil and dielectric samples. An important branch of the work done in the test room is in connection with breakdown tests on transformer oils. A special panel is provided for this work at one end of the laboratory. A h.p. supply is obtained from four 100/10,000-V potential transformers connected in series, and the control is effected by means of a phase shifter, one secondary of which is connected in opposition to the corresponding phase of the supply. This phase shifting apparatus is also used in connection with the testing meters on unbalanced circuits.

The supply of energy for the premises is taken from a sub-station adjacent to the stores building which supplies the company's local networks in New Southgate and Friern Barnet. This sub-station is fed through two feeders from the company's 11,000-volt system, terminating in B.T.-H. compound-filled truck-type switches.

In supporting Sir James Devonshire at the reception, Captain Donaldson, the company's chief engineer, paid a tribute to Mr. G. F. Shotter, the meter superintendent, who is responsible for the entire lay-out of the apparatus in the testing laboratory.

Tramways and Light Railways in 1924-25.

Annual Return.

As we have reported, the annual return of tramways and light railways (street and road) and railless trolley undertakings for 1924-25 has been published,* somewhat later in the year than the previous one.

The return covers the year 1924 in the case of company undertakings and the twelve months ended usually in March, 1925, in the case of municipal undertakings.

The statistics relate to 242 tramway undertakings, 170 owned by local authorities. During the period covered, the system of the Keighley Corporation was wholly converted to railless traction; and the Dearne District Light Railways Joint Committee commenced operations. Out of a total of 2,792 route miles authorised, 2,605 miles was open for traffic; 1,859 miles was worked by local authorities and 746 miles by companies. The total length of track in operation amounted to 4,381 miles.

The number of passengers carried during the period was 4,620,501,521, equivalent to 1,772,711 journeys per mile of route open. The car-mileage amounted to 378,239,229; of this 99.59 per cent. was worked electrically. The figures show that, as compared with the preceding period, the number of passengers carried increased by about 177,000,000, and the car-mileage by approximately 15,000,000. There was a slight decline in the efficiency of use of electrical energy; the total consumption was 707,038,431 kWh, giving an equivalent of 1.88 kWh per car-mile, as compared with 1.87 kWh in 1923-24. The average fare paid per passenger fell from 1.53d. to 1.47d.

The traffic receipts and expenditure of the undertakings is analysed in a table. From this it is seen that the gross receipts per car-mile declined from 19.46d. to 18.23d.; and the gross working expenses from 15.13d. to 14.43d., leaving net receipts of 3.80d. as compared with 4.33d. in 1923-24. The alterations were particularly marked in the case of company undertakings in which the receipts fell from 20.87d. per car-mile to 17.70d., and the expenses from 16.10d. to 14.20d., reducing the net receipts from 4.77d. to 3.50d. per car mile. The municipalities' net receipts were 3.87d. per car-mile, as compared with 4.23d. in 1923-24.

The amalgamated capital accounts show that the amount invested in municipal undertakings at the end of the period was £75,737,982 and that the companies' capital expenditure was £20,211,615, giving a total investment of £95,949,597.

In comparing the revenue statistics it is necessary to eliminate the amounts paid by lessee to lessor undertakings. With this adjustment the gross receipts amounted to £23,957,179 in the case of local authorities, and £4,780,460 in the case of companies, giving a total of £28,737,639. The working expenses were as follows:—Local authorities, £18,896,573; companies, £3,836,582; total £22,733,155. The 1923-24 totals were:—Receipts, £29,433,647; working expenses, £22,847,032. From these figures it will be seen that the ratio of working expenses to receipts rose from 77.74 per cent. to 79.10 per cent. As a further comparison it may be mentioned that this ratio was 76.23 per cent. in 1922-23, and only 64.51 per cent. in 1913-14. The net receipts for 1924-5 were £6,004,484 and sundry additions brought this up to £7,368,080; these additions included aid from rates amounting to £521,801. On the other hand, the allocations included £281,732 to the relief of rates; £2,057,442 to interest and dividends; £1,644,816 to debt repayment; £536,144 to income tax; £1,916,485 to reserves; £130,724 to capital works charged to revenue; and other charges making the total £7,173,412, and leaving a balance of £194,668 to be carried forward.

In accordance with the usual practice the 176 undertakings have been grouped into six classes according to their financial results. In Class I, comprising undertakings which showed a credit balance for the year, after meeting all charges in full, there were 99 undertakings—one more than in 1923-24—showing a combined balance of £419,708 as against £404,101 in the preceding year. Undertakings in Class II, after meeting all charges, made reserves in excess of the amount available; there were 6 of these as compared with 9 in 1923-24, but the combined debtor balance increased from £42,600 to £108,824. In Class III—undertakings which met interest and capital redemption but failed to cover income tax and other charges in full—there were 15 undertakings, against 11, and the aggregate adverse balance was £38,342, as compared with £17,056. Twenty undertakings (Class IV) were unable to meet their capital redemption charges (as against 22) and their total deficiency was £46,394, as against £46,435. In Class V, comprising systems that were unable to pay interest charges in full, there were eight undertakings, as against 5, the total debtor balance rising from £87,789 to £296,437. Eight undertakings (Class VI) were unable to meet their working expenses by an aggregate of £212,618 (as against £136,067). The total result was an overall debtor balance of £282,907, comparing unfavourably with a credit balance of £74,154 in 1923-24, and even more so with a balance of £223,103 in 1922-23.

The statistics of railless trolley undertakings are given in separate form. During the period reviewed 13 local authorities and one company actually carried passengers; 20 local authorities did not exercise their powers. Six undertakings appear in the return for the first time, *viz.*, Ashton-under-Lyne, Croydon, Lowestoft, Manchester, Oldham, and St. Helens Corporations. The total route-mileage in operation was 57.48 (local authorities 54.57 miles). The number of passengers carried was 24,261,748 and the number of car-miles run 2,670,562. The operating ratio was 84.40 per cent. in the case of the municipalities, 95.09 per cent. for the company (Mexborough and Swinton), and 84.43 per cent. overall. A table giving the results of the undertakings in pence per car-mile for five years shows that a remarkable improvement occurred during the year under review. While the income rose from 14.09d. to 14.27d., the expenses were reduced from 12.96d. to 12.10d., raising the net receipts from 1.13d. to 2.17d. per car-mile. The net receipts of the municipal undertakings averaged 2.23d. per car-mile, while those of the company undertaking were 0.67d. The detailed statistics show that the amount expended upon railless trolley systems at the close of their respective periods was £365,829 in the case of municipal authorities and £16,911 in the case of the company.

The revenue during the year was £152,335 for municipal undertakings and £6,411 for the company, and the expenditure was £128,567 and £6,096 respectively, giving balances of £23,768 and £315. Four local-authority undertakings were unable to meet their working expenses, incurring an aggregate deficit of £3,571. The total available in the case of municipal undertakings was £27,189. Against this were charged interest, taxation, &c., totalling £28,055, leaving an adverse balance of £866. The largest of the undertakings—the Teesside Railless Traction Board, with a capital expenditure of £85,269—not only met all charges but was able to contribute £4,695 to the relief of rates and to put £1,500 to reserve. It must be stated, however, that the undertaking made no provision for loan repayment or interest. The combined municipal undertakings carried 23,267,561 passengers at an average fare of 1.56d., and operated 2,557,172 car-miles.

*Stationery Office, 15s. net.

Scientific and Industrial Research Report.—We have received a copy of the Second Report of the Adhesives Research Committee of the Department of Scientific and Industrial Research, price 3s. net, postage extra. It covers the period of three years since the Committee's first report appeared in 1922, and contains an interesting account of the work of that body. A clear step forward in the study of the chemistry of gelatin has been made by the production of a gelatin of very high purity. The product differs very little in this respect from ordinary high-quality glues. A method has been elaborated for the extraction of high-grade gelatin from bones in a far shorter time than has hitherto been possible, and should prove of practical value. But an achievement which should have important economic results is the development of a method of extracting an *odourless* and *tasteless* gelatin of high adhesive value by simple treatment from fish skins. Investigations designed to throw light on the fundamental nature of adhesion have been undertaken, and have already enabled some tentative conclusions to be drawn as well as indicating the uses to which particular adhesives are specially suitable. It has also been demonstrated that, provided a small amount of heavy loading material, such as lead sulphate, is incorporated in the glue, which does not materially affect the strength of the joint, X-rays may form a valuable means of detecting flaws in joints in finished structures. Finally, research has been continued on the utilisation of castor bean residues, together with colouring substances and fillers such as sawdust, in the manufacture of plastic materials. Tiles taking a high polish and suitable for flooring have been produced, and use has been found for the adhesive in the manufacture of water paints and distempers.

The Electricity (Supply) Bill.

The Proceedings in Committee.

STANDING Committee C of the House of Commons began consideration of the Electricity (Supply) Bill on April 27th. Sir Robert Sanders was in the chair.

On Clause 1, which proposes to set up a Central Electricity Board, consisting of a chairman and seven other members appointed by the Minister of Transport, Mr. Attlee (Limehouse, Lab.) moved an amendment which, he said, would pave the way for a further amendment which stood in his name, and which had as its object the substitution of the Electricity Commissioners for the proposed members of the Board. He said that in the Bill, the Electricity Commissioners were to be in a *quasi*-judicial position. In a number of cases disputes would have to be decided eventually by the Commissioners, and the feeling had been expressed in various quarters that under the Bill, the Electricity Board and the Electricity Commissioners were not sufficiently distinct to allow of the Commissioners acting in a judicial manner towards the operations of the Board. The two were regarded, in fact, as semi-detached, and not wholly detached. The Labour Party thought that, as the Bill was drafted, it was impossible to disconnect the Board and the Commissioners, and in a later amendment the Labour Party would propose another tribunal altogether. If it were accepted that some other tribunal should be set up, it appeared to be unnecessary to continue to have two distinct bodies, the Electricity Board and the Electricity Commissioners. Therefore his first amendment would make the Commissioners and the Board one body. The Labour Party held that if their view were adopted, the whole of the Bill would be enormously simplified and a clumsy duplication of authorities would be got rid of.

SIR DOUGLAS HOGG, the Attorney-General, said that although the Government were most anxious to accept any amendments that would tend to improve and simplify the Bill, they could not accept Mr. Attlee's amendment. In the first place, the Electricity Commissioners already had, under the Act of 1919, very complicated and responsible duties to perform, which demanded a body mainly technical in character. All the Commissioners but one, who was a man of great financial experience, were electrical experts. That did not, in the view of the Government, constitute the sort of body which they desired or thought suitable for performing the functions entrusted to this Board. The Government view was that the Board ought mainly to be a Board of wide financial and business capacity, although, no doubt, some knowledge of electrical matters might be of assistance. If the Government were to seek to put on the Commissioners all the duties imposed on the Board under the Bill, they would be imposing on them a task far greater than they could adequately perform.

Mr. A. GREENWOOD (Nelson and Colne, Lab.) expressed the perturbation which the proposed Board gave rise to in the minds of the members of the Labour Party. So far as he knew, this would be the first time in history that a nondescript body of business men would have very direct control over local authorities.

Mr. G. BALFOUR (Hampstead, U.) pressed the Attorney-General to give his views on a number of amendments of the same type which appeared on the Order Paper, as did also Sir F. Hall and Mr. Hartshorn.

SIR D. HOGG said if it was the wish of the Committee that they should have a discussion on the composition of the Board, he was quite willing to make a general statement. The functions of the Central Electricity Board would be to carry out the main scheme of the Bill, which was to lay down main transmission lines, and to determine where electricity could most suitably and most economically be generated. Under the clause, as drawn, the Government had deliberately left the composition of the Board not too precisely defined. It was not too much to say that the successful constitution of the Board would be almost the decisive factor in the operation of the scheme. The Board was entrusted with wide powers and with very responsible duties, and it was essential to get the most suitable men, whoever they might be and wherever they might be found. If the Committee desired it, the Government would have no objection to providing in the Bill what certainly would be done whether it was provided in the Bill or not, that before the Board was actually nominated the Minister would consult representatives of the various interests affected. The Government recognised that the Board ought, of course, to avail itself of any assistance which the Electricity Commissioners could render. Under the Bill as drawn the Board had power itself, when once it was functioning, not only to delegate to committees certain powers—which he hoped it would exercise freely towards the general electricity authorities and bodies of that kind—but to set up consultative expert committees which would advise it on technical matters. On Clause 4 the Government would be prepared, if the Committee thought it right, to suggest that, instead of the Board's framing a scheme and submitting it to the Electricity Commissioners for their approval, the Board should frame a scheme in consultation with the Commissioners. That would probably accelerate the preparation of a scheme. If the Commissioners were to sit as an appellate tribunal on the scheme, it would be difficult to advise on its framing. The Government hoped that the relations between the Board and the Commissioners would be friendly, but they did not intend that the Board should cease to exist and that the Commissioners should be put in its place. The Government did not propose to accept a series of amendments designed to destroy the Board as an executive body and to turn it into a purely judicial tribunal. Such a proposal cut at the whole framework of the Bill. It would be a mistake for the Board to be an elected body, but it should be, as the Commissioners were, a nominated body.

Mr. Attlee pointed out that Clause 4 provided for the hearing of parties to a scheme, but before whom would they be heard if the Commissioners were to be also responsible for the scheme?

SIR D. HOGG said that the Government proposed to substitute an appeal to the Minister of Transport from the scheme as constituted by the Board in consultation with the Commissioners. The Government thought that a tenure of office of five years was the minimum for a member of the Board, and there would be power to re-appoint any member at the end of that period. He felt that not less than five years and not more than ten years, would be a workable compromise. The Government was not prepared to debar a member of the House of Commons from sitting on the Board. Debates showed that there were members of the House who would be eminently desirable members of the Board. The Government had decided that there should not be representatives of various interests on the Board. It was not intended that each interest should nominate an individual for membership of the Board. He did not think it would be desirable to exclude a person from membership on the ground that he was directly or indirectly interested in the supply of electricity. For instance, if they were able to get Mr. Samuel Insull, of Chicago, to sit, he would be very sorry to find him disqualified because of his interest in electricity.

SIR JOSEPH NALL (Manchester, Hulme, U.) pressed the Attorney-General for further information as to the appeal which he had suggested from the Board. It now appeared that after the Commissioners and the Board had initiated a scheme, the parties interested would have a right of being heard, but by whom? By the Commissioners who initiated the scheme. They could then appeal to the Minister of Transport, who, presumably, when he heard the case, would have the Commissioners present with him. Could it be seriously contended that that was an appeal within the ordinary common practice adopted in this country?

SIR J. MARRIOTT took the same view, and SIR C. WILSON urged that the Board and the Commissioners should be consolidated, as there was not the slightest necessity for the two bodies. One competent body should be appointed which would have a fair chance from the State of being successful in its object.

After further debate, in which Mr. HARMSWORTH (Isle of Thanet, U.) and Mr. GROTRIAN (Hull, U.) urged the creation of an impartial appeal tribunal, Sir D. HOGG said that he did not think it was intended to lay down by Clause 1 that the Electricity Commissioners were to become a judicial body, or anything like it. It certainly never had been the intention of the Government, or of anybody connected with the scheme, that there should not be an effective appeal, and, of course, the suggestion that the Minister, after the Board had consulted with the Commissioners and prepared a scheme, should then consult the Commissioners as to whether the scheme should be approved would be a travesty of an appeal, and would also be a travesty of what he was going to propose on reaching Clause 4. He deliberately did not elaborate the appeal, but the suggestion would be that, just as under the 1919 Act, when the Commissioners had prepared a scheme it went up to the Minister for confirmation and the Minister decided, not in consultation with the Commissioners, because, if there was an appeal from their decision, they could not be consulted as to the hearing of the appeal, so, when there was an appeal under Clause 4 in regard to any scheme, there should be appointed by the Minister some appropriate person to hear everyone's objections. But every time one multiplied the hearing of the appeals, with expert witnesses, learned counsel, and the other paraphernalia of a judicial hearing, one added enormously to the costs which so far as the Board was concerned, would have to be borne by the consumers in the long run. A multiplicity of hearings and re-hearings, too great a delay, and too great an expenditure, would kill the scheme. With those qualifications, he was perfectly content to consider, when Clause 4 was reached, what was the best and most practicable way of creating an appeal in which the Committee would have full confidence. On the present amendment of Mr. Attlee's, the Government must adhere to the view that it was essential that there should be a Central Board, as well as the Commissioners.

The Committee then adjourned.

When the proceedings were resumed on April 29th, Mr. R. S. HUDSON, the Unionist member for Whitehaven, said that since the previous meeting of the Committee a number of members had been trying to find a way out of their present difficulties with regard to an appeal. There was a general feeling that there ought to be some form of an appeal tribunal. Discussion in the Committee would be simplified if it could

be borne in mind that there were two stages in the life of the Board. The first was the forming of the scheme, and the second was the administering of the scheme, and the relations between the Board and the Commissioners were not necessarily the same at both stages. It would shorten discussion if the Committee would regard the first four clauses of the Bill as forming a whole, and discuss on them the relations of the Board and the Commissioners during the first stage, and leave the relations between the Board and the Commissioners in the administrative life of the Board to a subsequent discussion. If that met with the approval of the Committee and the Government he would suggest that the Government should undertake, when Clause 4 was reached, to agree to the positions of the Board and the Commissioners being reversed—that the Commissioners, the technical people, should form the embryo schemes and that they should publish them, and that the Board should then hold a hearing and become a Court of first instance, giving an opportunity for all the interested parties to put forward any objection to the schemes. The Board, after hearing all parties, would then make such alterations in the scheme as it thought fit, and would publish the scheme. There should also be some kind of small appeal tribunal, which would hear only appeals from persons who considered that their interests had been prejudicially and unreasonably affected by the scheme adopted by the Board. It should not be allowed to consider anything that would have the effect of destroying any fundamental principle of the scheme, because it could not be expected that men of the eminence of those who would compose the Board, would, after drawing up a scheme, submit to the over-riding of that scheme by some appeal tribunal.

Sir D. HOGG agreed that the functions of the Board could be properly looked at in two different stages. He had had communications from more than one member of the Committee making suggestions with a view to meeting the difficulties which some members had indicated last time, and he was grateful to them and to Mr. Hudson for trying to discover some amendment which would not render the Bill unworkable, and which, at the same time, would meet the difficulties of getting some kind of appeal which would be speedy and cheap. He thought that in Mr. Hudson's suggestion there was at any rate hope of a successful solution. If Mr. Hudson and those associated with him would be good enough to frame the precise amendment which they suggested, he would be prepared to consider it favourably when Clause 4 was reached. As for Mr. Attlee's amendment, if Mr. Hudson's plan were to be adopted it would be necessary to reject that amendment, which, indeed, would pave the way towards the nationalisation of the industry, which the Labour Party desired.

In the discussion which followed, Sir C. WILSON (Leeds, Central, U.), announced his intention of supporting Mr. Attlee's amendment, as he was opposed to Mr. Hudson's suggestion, and Sir J. MARRIOTT (York, U.) declared that he declined to be frightened by the bogey of Socialism, and, in the absence of a definite assurance from the Government that a judicial appeal tribunal should be set up, he would also support the amendment.

Lt.-Col. ASHLEY, the Minister of Transport, agreed that it would be better for the Board to have the final say in the scheme, and not the technical experts. The Government was perfectly willing to consider favourably the suggestion that the Bill should be turned round, that the Electricity Commissioners should frame the scheme—which they were eminently suited to do with their long experience and distinguished service—and that the Board should then consider the scheme and receive representations from those people who thought that they were adversely affected by it. Previous to that, the Board would, of course, have published the scheme. Then, those who considered themselves adversely affected financially by the scheme should have that the right of appeal from the Board to an independent tribunal. Such a proposal would, he thought, meet all the legitimate objections of those who wanted the Bill to go through. All that the Government desired was that there should be an independent appeal tribunal which would inspire confidence.

Mr. A. GREENWOOD (Nelson and Colne, Lab.) accused the Government of capitulating to those very interests which it had declared it would stand up against, and of letting down the local authorities.

Mr. G. BALFOUR (Hampstead, U.) regarded with favour the Government's new suggestion as to appeals.

Mr. MARDY JONES (Pontypridd, Lab.), in supporting Mr. Attlee's amendment, declared that the Commissioners, with their large technical knowledge, should remain as the nucleus of any Board that might be set up. He agreed that there should certainly be some form of appeal tribunal.

Mr. HARDIE (Glasgow, Springburn, Lab.), asked some some assurance that the Board should not get into the hands of the business "sharks."

In view of the concessions which had been made by the Government, Sir C. Wilson intimated that he would withdraw his support from the amendment.

Mr. Attlee's amendment was defeated by 50 votes to 17.

Mr. GRANT (Derby, S., U.) moved an amendment to provide that the Chairman of the Board should be "an experienced lawyer." Sir D. Hogg resisted the amendment, in view of the fact that the Board was to be entrusted with very important business functions. After discussion, the amendment was withdrawn. The Committee then adjourned until Tuesday, May 4th.

(To be continued.)

Czecho-Slovakian Imports and Exports.

THE December issue of the monthly foreign trade returns of Czecho-Slovakia contains in a summarised form certain details of the imports and exports of the country for the twelve months of 1925. From these, the following figures relating to electrical material have been extracted, the corresponding statistics for 1924 having been added and notes of increases and decreases given. It will be noticed that imports of heavy apparatus are considerably greater than exports.

Imports.

	1924. Quintals.*	1925. Quintals.	Inc. or dec.
Dynamos and motors and apparatus permanently combined with them, also transformers—			
Total	12,668	17,563	+4,895
From Germany	5,411	8,343	+2,932
,, Austria	6,032	7,444	+1,412
,, United States ...	20	121	+ 101
Telegraph apparatus, &c.—			
Total	234	250	+ 16
From Germany	54	89	+ 35
,, Austria	150	150	—
Measuring and calculating apparatus—			
Total	1,437	1,680	+ 243
From Germany	994	1,127	+ 133
,, Switzerland ...	322	425	+ 103
Lamps, arc, incandescent, &c.—			
Total	1,363	1,780	+ 417
From Germany	466	552	+ 86
,, Hungary	338	457	+ 119
,, Austria	260	313	+ 53
,, Holland	263	406	+ 143
Electrical apparatus and electro-technical devices—			
Total	4,126	6,629	+2,503
From Germany	2,344	4,136	+1,792
,, Austria	1,295	1,459	+ 164
,, Switzerland ...	135	174	+ 39
,, France	65	392	+ 327
,, Hungary	15	42	+ 27
Cables and insulated wire—			
Total	382	231	- 151
From Germany	98	63	- 35
,, Austria	249	112	- 137
Carbons—			
Total	6,415	8,664	+2,249
From Germany	4,691	4,546	- 145
,, Austria	202	644	+ 442
,, Jugo-Slavia ...	1,365	2,364	+ 999

Exports.

	1924. Quintals.	1925. Quintals.	Inc. or dec.
Dynamos and motors and apparatus permanently combined with them, also transformers—			
Total	8,998	7,440	-1,558
To Austria	2,858	1,312	-1,546
,, Jugo-Slavia	385	702	+ 317
,, Germany	1,387	1,082	- 305
,, Poland	727	777	+ 50
,, Hungary	516	1,510	+ 994
Telegraph apparatus, &c.—			
Total	981	1,308	+ 327
To Austria	786	489	- 297
,, Germany	157	540	+ 383
Lamps, arc, incandescent, &c.—			
Total	2,687	3,254	+ 567
To United States	1,106	629	- 477
,, Austria	141	298	+ 157
,, Hamburg	317	742	+ 425
Electrical apparatus and electro-technical devices—			
Total	1,675	2,631	+ 956
To Austria	470	357	- 113
,, Germany	378	313	- 65
,, Poland	109	213	+ 104
Cables and insulated wire—			
Total	2,023	2,383	+ 360
To Rumania	578	577	- 1
,, Jugo-Slavia	490	538	- 48
,, Great Britain	244	461	+ 217
Electric carbons—			
Total	37	171	+ 134
To Jugo-Slavia	10	74	+ 64
,, Austria	8	43	+ 35

(* Quintal = 2 cwt.)

New Electrical Devices, Fittings and Plant.

(Readers are invited to submit particulars of new or improved devices and apparatus.)

The "Heatrae" Electric Water Heater.

Figs. 1 and 2 show a domestic hot-water supply tank and a bath-water heater which have recently been introduced by MESSRS. ELECTRIC FIRES, LTD., King Street, Norwich. The domestic tank is fitted with a ball valve, operating in an entirely independent valve chamber. The water chamber is well lagged and enclosed in an outer casing, and a suitable overflow pipe and draw-off tap are provided. The heating apparatus consists of a small constant heater and a separate booster heater, the latter being of the combined switch and immersion-heater type, if desired, so that the whole is self-contained. The tank is made in capacities of from 10 to 30 gals., with constant and booster loadings of from 200 and 2,000 W to 300 and 4,000 W respectively. The bath-water heater consists of a

Fig. 1.—Domestic Hot-Water Tank.

Fig. 2.—Bath-Water Heater.

specially designed, unlagged, cylindrical copper tank. The cold-water inlet is taken to the top of the tank, the inlet pipe being fitted with a water control valve. The feed-water arrangement is such, it is claimed, as not to allow the water to syphon back in the event of the water supply failing, and provision is made on the outlet pipe to prevent dripping whilst the water is heating up. The loading is 4 kW and the capacity is from 5 to 15 gals. Both heaters are finished in white sprayed enamel.

A New Design of Tumbler Switch.

We have received from MESSRS. "M.K." ELECTRIC, LTD., Wakefield Street, Edmonton, N.18, a sample of a new tumbler switch, fig. 3, which they have recently placed on the market. The design is on the general lines of the makers' foot-press switch, used in connection with electric fires, and can be supplied in the surface, sunk and semi-sunk types. The rated

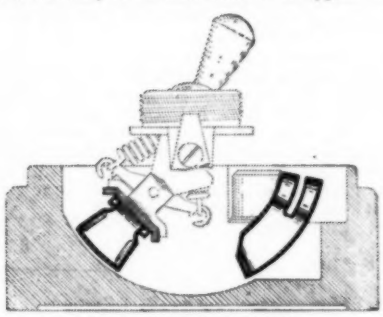

Fig. 3. Long-Break Switch.

capacity of the switch is 5-7 A and its special design and exceedingly long break renders it capable, it is claimed, of making and breaking four times that capacity. Two tripping links, actuated by the dolly irrespective of the spring movement, give the contact arm a positive action throughout its entire stroke. A quick-make and-break action is transmitted by a strong flexible spring. The contacts are of phosphor bronze and the insulation is of pure mica which is specially treated to prevent surface leakage when installed in damp places.

The "Domestic" Electric Water Heater.

The accompanying illustration, fig. 4, the "Domestic" cistern, is one of a range of such apparatus which has been placed on the market by MESSRS. INVENTUM ELECTRICAL APPLI-

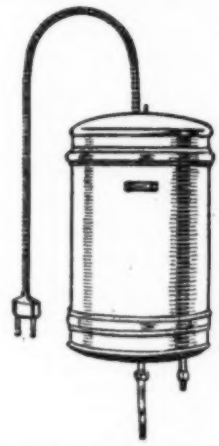

Fig. 4.—"Domestic" Water Heater.

ANCES, 124, Chancery Lane, London, W.C.2. The elements are of the electric-iron type encased in a tinned-copper sheath from which they can be withdrawn without emptying the tanks. The outer casing is of galvanised iron, while the inner casing or tank is constructed of tinned copper and is lagged with shredded cork. The apparatus is fitted with the "Inventum" bi-metallic thermostat (for use on a.c. only) which, it is claimed, can be adjusted to operate at any temperature up to 202 deg. F., the usual "temperature drop" allowed between "cutting" out and in being 10 deg. F. The capacity of the cistern is 1.5 gal., and the loading is 500 W. The range includes apparatus with capacities up to 22 gal. at loadings up to 500 W. A feature of the appliances is that the whole of the working parts can be removed, it is claimed, in 5 min., and the interior easily cleaned of scale and deposits, this possibility enabling a higher water temperature to be maintained.

A Non-Metallic Electric-Heating Element.

We have received from THE BRITISH RESISTOR CO., LTD., 32, Clare Road, Halifax, some particulars of a non-metallic element, "Globar," which they are introducing into this country. "Globar" resembles in appearance silicon carbide and the elements are usually manufactured in the form of round rods, ranging from 3 to 60 in. long, and from ¼ to 1 in. in diameter. The material is claimed to be unaffected by gas and chemical fumes and to have practically no coefficient of expansion, enabling liquids to be poured over the elements when operating at high temperatures. It is also claimed that the material does not decompose under temperatures of 3,000 deg. F. and that the material is being commercially used in electric furnaces for working temperatures up to 1,350 deg. C. The terminal portions of the elements are specially treated for increasing their conductivity. A variable characteristic of the material is its change in resistance through use, but it is claimed that this can be made negligible or entirely compensated for by the correct design of the apparatus.

A Car-Lighting Fitting.

THE LODGE FITTINGS CO., LTD., 57, Albert Road, Aston, Birmingham, has sent us a sample of its "Classic" car-lighting fitting, fig. 5, which has recently been put on

Fig. 5.—Car-Lighting Fitting.

sale. The device is designed as a trough lighting unit and accommodates a small b.c. lamp at each end. The trough is arranged as a revolving shutter so that the light can be focused to the most convenient position. The shutter is held at any position in the two end "caps" by virtue of its own spring, and it can be revolved by slightly pressing its centre at the edge. The device is contained in a suitable bracket which is fixed in the desired position by means of two screws. The inside of the shutter acts as the reflector and is silver-plated. The other parts are oxidised.

Parliamentary News.

[By Our Special Parliamentary Reporters.]

Damage by Electric Wires.—On April 27th, Major RUGGLES-BRISE asked the Minister of Transport whether he was aware of certain contingencies which might arise, causing injury to persons, buildings, fences, crops, or stock during or after the erection of above-ground transmission lines or other electric lines.

Colonel ASHLEY said that owners and tenants of private land were safeguarded by the existing provisions contained in Section 22 of the Electricity (Supply) Act, 1919, and he did not consider that further provisions were necessary.

Fuel Economy.—On April 27th, in reply to questions by Mr. HANNON, Lord Eustace Percy said that research on the economical utilisation of fuel was being carried out under the Fuel Research Board of the Department of Scientific and Industrial Research. An account of the work in progress was given in the Report of the Royal Commission on the Coal Industry (Chapter IV), and fuller information would be found in the annual reports of the Fuel Research Board and of the Department of Scientific and Industrial Research.

P.O. Power Station at Taunton.—On April 27th, Lieut.-Colonel GAULT asked the Postmaster-General whether he was aware that an independent power plant was being installed by his department at Taunton, where there was already an efficient and cheap public supply of electricity available with an adjacent main from the Taunton Corporation; and whether, in the interests of national economy, he would reconsider the erection of this plant and make use of the power generated from the existing system.

Sir WM. MITCHELL-THOMSON said he was aware that arrangements were being made to install an independent electric generating plant in the new telephone repeater station at Taunton. It was essential to equip repeater stations with a complete electrical power unit, for use in emergency. At the smaller stations, such as that at Taunton, it was more economical to provide a second power unit and thus make the station self-contained, than to install the special plant which would be necessary to utilise energy from the public supply.

Wireless Experiments with America.—On April 27th, Sir A. SINCLAIR asked the Postmaster-General whether His Majesty's Government refused to conduct experiments in wireless telephony with either Australia or Canada on account of its commitments in the United States of America; and if so, whether he would explain the nature of these commitments and how long they would last.

Sir W. MITCHELL-THOMSON said that the only reason why the experiments had so far been confined to the United States was that the United States was the only country equipped with suitable transmitting and receiving apparatus for the purpose of reciprocal experiments. The Government was under no obligations to the United States which would preclude its undertaking experiments with Canada or Australia in the event of stations equipped for the purpose being provided in those Dominions.

Electricity Meters.—On April 29th, Viscount SANDON asked the Minister of Transport whether he would consider the desirability of taking power to safeguard the consumer by inflicting penalties on electricity companies where the meters were faulty and recorded excessive readings, and by inspection of these meters.

Colonel ASHLEY said he did not propose to suggest an alteration in the existing law on this subject, which, in his opinion, already adequately safeguarded the interests of the consumer.

The Doncaster Corporation Bill.—This Bill, which includes a clause giving the Corporation certain powers with regard to the wiring of houses and the supply of electrical fittings, was to come before a House of Lords Committee on May 3rd, but was adjourned *sine die*. We are informed that there is no opposition on the part of the Electrical Contractors' Association.

Legal.

Alleged Mercurial Poisoning.

AT the Birmingham County Court, on April 28th, before His Honour Judge Ruegg, Lucy E. Goffe, Gravelly Hill, claimed for compensation, under the Workmen's Compensation Act, against the Birmingham Corporation, in respect of the death of her husband, Richard Goffe, on February 24th. He was employed as a meter repairer in the Electric Supply Department, and the applicant's contention was that his death was due to an industrial disease, namely, mercurial poisoning. Respondents contended that death was due to natural causes. Mr. WARD (counsel for applicant) said Goffe was 23 when he died, and his dependants were a widow and one child. He was in the employ of the Corporation for seven years, and it was in respect of the last two years that it was alleged mercurial poisoning was set up. During that time he was employed to inspect electricity meters in houses and factories, and possibly to clean them when it was required. These meters contained mercury, and before he was engaged on this work Goffe was strong and robust, but afterwards he complained of headaches, depression and internal pains. A local practitioner was called in, and he came to the conclusion that Goffe was suffering from poisoning in some form. Counsel described Goffe's symptoms as time went on, and said his wife had seen him remove small pellets from his hair and clothing. Paralysis and death ensued. A post-mortem examination was made by Professor Haswell Wilson, two days after the death, but no traces of mercury were found in the body at that time. Certain of the organs were sent to Mr. Rigby, an analyst, who then found traces of mercury in the liver, the kidney and the spleen. In the other parts of the body he found no traces. Counsel's submission was that although the final cause of death was myelitis, that myelitis was brought about by mercurial poisoning. Professor MORRISON said death was due to myelitis, and no mercurial poisoning was present, his reason for saying this being that there was no change in any organ such as would be produced by chronic mercurial poisoning. Professor HASWELL WILSON, Professor of Pathology at Birmingham University, who made the post-mortem examination, said he found no evidence of mercurial poisoning. His HONOUR, after consulting the medical referee, said that the matter would require careful consideration, and judgment would be reserved.

Marconi's Wireless Telegraph Co., Ltd., v. Pearl's Bargain Stores.

IN the Chancery Division, before Mr. Justice Astbury, on April 28th, Mr. Trevor Watson moved for judgment in the case of Marconi's Wireless Telegraph Co., Ltd., against Pearl's Bargain Stores. Counsel said that this was a patent action. A defence was delivered, but it contained no particulars, and an order was made for particulars which had not been complied with and in consequence there was no defence. He therefore asked for judgment in the ordinary form—an injunction delivery-up, and an inquiry as to damages.

His Lordship gave judgment accordingly.

British Electric Vehicles, Ltd.

MR. JUSTICE ROMER, in the Companies' Winding-Up Court, on April 27th, made an order for the compulsory liquidation of British Electric Vehicles, Ltd., on the petition of Batteries, Ltd.

Counsel for the petitioners said that they were creditors for £429 for goods supplied. There was no appearance for the respondent company, and no opposition.

Correspondence.

Correspondents should forward their communications at the earliest possible moment. ***No letter can be published unless we have the writer's name and address in our possession.***

British Goods Handicapped in Australia.

Being a comparative newcomer to Australia, there are one or two points I would like to bring to the notice of your readers. I have been in the electrical industry in London, Birmingham, and Manchester, and am naturally an enthusiast for British goods, and have found no difficulty in selling them against foreign makes. The majority of native Australians are not enthusiastic, and I think these are some of the reasons. There is a general feeling that America leads on manufactured goods, due to the advantage gained during the "drugged and doubting years" 1914-1917; the American representative is not slow to take advantage of this. Even worse, a representative of the B.E.A.M.A., writing in one of this week's trade journals, talks of unrelieved gloom in the electrical industry at "home." Would you give an order to a traveller who said his company was nearly bankrupt? Another point: Why do reputable English manufacturers give their agencies to men who have no sympathy with British trade? Very often a good agency is run in conjunction with Japanese goods, or even Belgian dolls. The agent very often does not know anything about the goods, and will show an English cast article against an American stamping; when asked to explain the difference in price, "one is English and one American" is all he knows. Does the average manufacturer know how large Australia is and what it can take in electrical goods?

Wake up! Cheer up!

Salesman.

March 25th, 1926.

Three-phase, 4-wire Distribution.

Referring to "Inquirer's" question in your issue of the 23rd ult., perhaps the following remarks may be of assistance to him. I am presuming that his letter referred to a group of three single-phase transformers, and that the actual text, as printed, is in error when it states that "three THREE-phase core-type transformers" were to be connected star/star.

If unbalanced single-phase loads are connected between phase lines and secondary neutral, the star/star-connected bank will not operate successfully unless the primary neutral is connected to the neutral of the generator.

Assuming that a single-phase load be connected between one phase line and the secondary neutral, and that the other

two phases are not loaded, then the current for the load will flow through the neutral line, through the secondary of one phase of the transformer, and through the phase line connected to the loaded phase of the transformer. A load of this kind draws current from only one secondary of the transformer. A corresponding current must flow in the primary winding of the loaded phase. But, when the primary is star-connected, and its neutral is not connected to the neutral of the generator, then the current for the loaded phase must pass through one or both of the other phases. Similar results are produced when the three phases are unequally loaded by connecting single-phase loads of different values between phase lines and neutral. The voltages induced in the phases due to unbalanced load are in addition to the impressed voltages. The resultant voltages produce extra voltage stresses on the insulation, and may produce a high iron loss, which may increase the temperature of the transformer. If the primary neutral (of the transformers, or transformer, if it is three-phase) be connected to the generator neutral, the transformers should operate satisfactorily, provided they are of good design.

W. G. Stuart.

Trethomas, *May 1st*, 1926.

[The wording was published as received by us.—EDS. ELEC. REV.]

Propeller-type Runners for Hydraulic Turbines.

We have read with interest the article in your issue of April 23rd pointing out the advantages of the Kaplan runner. But are its advantages over other propeller runners worth its high cost, and greater liability to breakdown, due to the necessity of installing a large amount of mechanism in a most inaccessible part of the turbine?

It is true that owing to its higher speed the alternator should be cheaper, but then other factors arise which tend to neutralise this advantage.

It is also true that high efficiencies at low gate openings are obtained, but in practice all large stations have two or more units, and it is therefore not necessary to operate the turbines at their low gate openings.

When considering the Lilla Edet scheme, the Swedish Government engineers thoroughly investigated and tested the relative advantages of the Kaplan and Lawaczeck runners, and the result of their investigations was that one Kaplan and two Lawaczecks were ordered. We believe their main reason in coming to this decision was greater assurance of reliability with the latter.

The first trial run of the Lawaczeck turbine has already taken place, and when tested on a net head of 6.2 metres, this turbine gave 11,000 b.h.p. against a guaranteed output of 9,350 b.h.p. on that head.

James Gordon & Co., Ltd.
JAMES GORDON, *Director.*

London, *May 1st*, 1926.

The Heating of Buried Cables—Report No. 2.

We are much indebted to Major Taylor for calling attention, in his letter published in your issue of April 30th, to the discrepancy in the formulæ for calculating "K" as between the earlier report in 1921 and the later one as published in the *Journal* of the Institution of Electrical Engineers, Vol. 61, p. 517 *et seq.* In the first report the quantity "Q" was used to represent the heat developed in the whole cable, and was correctly employed in the corresponding formulæ. In revising the symbols for the larger report it was the wish of the Sub-Committee to employ the quantity "H" to represent the total heat in watts developed in each centimetre length of each conductor as set out on p. 534 in the *Journal*. Owing to a regrettable slip the formulæ as previously given for "Q" were not corrected for this different meaning of "H," so that, while formula (23) is correct, "H" should read "2H" in formula (24), and "πH" in formula (25). None of the values of the thermal resistivity given in the report are affected by this *lapsus calami*.

Major Taylor's comments hardly serve to make the matter clear, and his description of a 3 : 1 error as an error of 300 per cent. needs revision, but in view of his letter referring specifically to Mr. Melsom's work and his present absence in America, I, as joint author of the report, beg to offer the above explanation with the approval of the Director of Research.

Printer's errors which escaped correction in the *Journal* occur in equation (58) where "r" should be "R_1," and in equation (37) where "I_2" should be "F."

E. Fawssett.

Westminster, *May 3rd*, 1926.

Science Congress in France.—The annual congress of the French Association for the Advancement of Science is this year to be held in Lyons from July 24th to August 1st next. For the last ten years an exhibition of scientific apparatus has been held in connection with the Congress, but as this year's is the fiftieth of the Congress it has been decided to give the display of scientific and technical apparatus a much more comprehensive character. Interested firms can obtain particulars of the exhibition from the offices of the Foire de Lyon, 1, Rue Blanche, Paris.

Reviews.

Junior Technical Electricity. By R. W. HUTCHINSON, M.Sc. Pp. viii + 382; figs. 327. London: University Tutorial Press, Ltd., and W. B. Clive. Price, 4s. 6d. net.

A fair idea of the scope of this book may be obtained from the fact that the first diagram is of a piece of magnetite with iron filings adhering to it and the last is of a three-valve wireless receiving set. The book is issued as a First Year Course in Electrical Engineering for students in Technical Schools and Colleges, and, in view of the fact that no previous knowledge of electricity is assumed, we are inclined to regard the author's estimate of the time taken to cover the course as a trifle optimistic. However, admitting the truth of the adage, "A man's aim should exceed his grasp," and allowing Mr. Hutchinson a certain latitude in his measurement of time and human capacity, we would say at once that he has covered much ground with thoroughness and has struck a good balance in his treatment of the theory and practice of electricity.

There are twenty chapters in the book and the subjects are taken in the usual order, the first five chapters treat of Magnetism and the two next of Electrostatics, while the latter part of the book treats in succession the properties of currents and the phenomena of electromagnetic induction and its application to generators, motors, instruments and telegraphy.

While realising the importance of good electrical conductors few students of electrical engineering gain sound conceptions concerning the properties of magnetic materials and often fail to appreciate the value of low hysteresis losses. It is satisfactory to note that some stress is laid by the author on magnetic properties and the practical applications of magnetism.

We must confess to finding the chapters on Electrostatics a little *dry*, an impression that is intensified rather than diminished by the very free use of *italics* and the frequent changes of type.

The chapters on the magnetic, chemical and heating effects of the electric current are sound and practical. We rather doubt the wisdom of devoting so much space nowadays to arc-lamps, and would suggest that, in view of the greater use of the arc for welding and furnaces, brief reference to these applications would have been preferable to details of arc-lamp mechanisms. Generators and motors are treated in an elementary but useful manner, and there is quite a good concluding chapter on radio communication.

A useful feature of the book is the number of worked examples, and there are also exercises appended to each chapter. Viewing this book side by side with its elder brother "Technical Electricity," we are somehow reminded of a now famous poster in which an emaciated bather contemplates his corpulent reflection in the convex surface of a familiar bottle. But while the addition of the word "Junior" to the title has produced some emaciation it does not seem to have impaired the soundness of constitution of this last addition to Mr. Hutchinson's literary family.

P.H.S.K.

Telephone Communication Systems. By ROYCE GERALD KLOEFFLER, Kansas State Agricultural College. Pp. vii + 284; figs. 213. London: Macmillan Company. Price, 17s. net.

This, the latest manual of the Engineering Science Series, has for its object the presentation of the subject of telephony in a general manner suitable for short college courses in that particular field. In the twenty-two chapters into which the work is divided, the author deals with the transmitter and receiver, magneto and signalling systems; non-multiple, multiple and universal switchboards, intercommunication systems, automatic telephony—Strowger and panel-type—lines, testing, repeaters and multiplex telephony, and radio-telephony.

Detailed descriptions of apparatus and circuits are avoided by selecting typical items illustrative of fundamental principles. Realising the difficulty which many students experience in tracing out complicated circuit diagrams, the author, by the use of partial circuits, leads up to the more complicated complete ones; and although unable, within the limits to which he has restricted himself, to go into too much detail, succeeds in giving the reader sufficient to enable him to obtain a fair grasp of the subject. The volume is fully equal to the other members of the series in the excellence of its illustrations and letterpress, and although written from the American standpoint, will prove a useful book to those whom the author describes as "having to explain communication problems to the public and others."

Turbo Blowers and Compressors. By W. J. KEARTON. Pp. xv + 333, with 152 illustrations, including 7 folding plates. 8¼ in. by 5¼ in. by 1¼ in. London: Sir Isaac Pitman & Sons, Ltd. Price, 21s. net.

The development of the high-speed electric motor has led to the introduction of many entirely new types of machines for all manner of industrial processes. Instead of being driven either directly by low-speed reciprocating engines or through belts or toothed gearing, the machine can be direct-coupled to the motor, and owing to the high speed of the latter a light, compact, and therefore less costly, unit is obtained. A very good example of this new type of machine is to be found in the turbo-blower and centrifugal compressor—the author does not deal with the reciprocating compressor—and it is this new type of machine which forms the subject of this book. These machines have been developed to take the place of the low-

speed reciprocating blowers, compressors, gas pumps and exhausters, and it is indicative of their recent introduction that this is the first text-book published in this country dealing exclusively with their design, construction and regulation.

The theory of the centrifugal pump is familiar to every engineering student and can be easily understood, but the theory of the centrifugal blower or compressor, which is in reality a centrifugal pump dealing with compressible fluids such as air, coal gas, &c., instead of incompressible fluids such as water and oil, is not so easily explained. The author, however, deals with this part of his subject in his opening chapters in a very direct and concise manner, giving first of all a chapter on the compression of air in which he discusses the usual theories of isothermal and adiabatic compression, entropy, specific heat, and work, all of which are equally applicable to rotary as to reciprocating machines. The problems of the losses inseparable from the centrifugal compressor, the necessity of interstage cooling and the various cooling systems employed, and the efficiency of this type of machine are then discussed, the more theoretical part of the book being closed with a chapter on regulation.

What we may term the second part of the book deals with the more practical problems of design, testing, and operation. In this part the author has described in detail, illustrating his remarks with a number of folding plate drawings as well as smaller detail drawings, of actual machines, these including blowers for blast furnace and cupola work, compressors having eleven or twelve stages, and capable of delivering air up to pressures of 100 lb. per sq. in. and suitable for pneumatic plant as well as exhausters for operating ash suction, and grain suction plants. A useful chapter on the critical speed of shafts is included in this section and while one could suggest that it might rather find a place in a text book on strength of materials, its inclusion is justified by the application of the theories given to the case of high-speed blower and compressor shafts. Another very interesting chapter is that dealing with the turbo-blower as an auxiliary to the internal combustion engine. For the two-stroke engine this type of machine is used for scavenging the cylinder, while for the four-stroke engine it finds its application for supercharging, which is, of course, equally applicable to the engine working on the two-stroke cycle. An interesting application of this is to be found in the aero engine, where blowers driven by exhaust gas turbines are employed to overcome the effects of reduction in the atmospheric pressure with altitude.

It will be realised, therefore, that this book deals very fully with the subject from the point of view of the student and the designer. We would have wished that the author had in one of his preliminary chapters given a brief *résumé* of the various purposes to which the rotary blower for pressures up to, say, 10 lb. per sq. in. and the centrifugal compressor for pressures above this figure have been put, and of their advantages and disadvantages as compared with the reciprocating types. It might also have been of interest if some suggestions could have been made as to the possibilities of further applications and developments of the rotary machines. From the electrical engineer's point of view these have the advantage of requiring the electric motor to drive them—unless, indeed, they are so large that they are direct coupled to the steam turbine itself, as is already being frequently done. But with these reservations we can heartily recommend this book to all those who are interested in this newer and more economical method of compressing gases.

Trade-Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from April 28th :—

H.G., Horace Green & Co., Ltd., Cononley, Keighley, Eng. (lettering and design). No. 455,001. Class 6. Electric motors and dynamos.—Horace Green and Co., Ltd., Cononley, Keighley.

Permatector. No. 467,806. Class 8. Rectifiers for radio receiving sets.—Brownlie Wireless Co. of Great Britain, Ltd., 310a and 312a, Euston Road, N.W.1.

Miniloss. No. 468,211. All goods in Class 8.—Sterling Telephone and Electric Co., Ltd.

Ceag (lettering and design). No. 453,217. Class 13. Electric lamps, contacts and terminals, fittings, fusible cut-outs, switches, &c., all for use in connection with miners' electric safety lamps.—"Ceag" Miners' Supply Co., Ltd.

Harelda (lettering and design). No. 465,583. Class 13. Electric lamps (ordinary).—Harelda, Ltd., 5, Suffolk Street, Pall Mall, S.W.1.

The L.C.C. Tramways and Street Improvements.—Since the London County Council commenced to operate tramways, in 1899 the undertaking has been called upon to make contributions towards the cost of the widening of streets through which the tramways run, and the annual charge has been in the neighbourhood of £30,000. The Highways Committee considers that the time has arrived when the undertaking should be relieved of a burden which is not shared by other transport systems, except in such cases where the cost of improvement is increased by the special requirements of the tramways. Where improvements are carried out solely on account of the tramways, the cost should be charged wholly or partly to the tramway accounts. A resolution embodying recommendations on these lines was to be submitted to the London County Council on Tuesday last.

Published Specifications.

Compiled expressly for this journal by Patent Agents.

The name of the applicant's patent agent, if any, will be found on the printed specification.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1924.

6,510. "Methods of protecting electric transformer oils against oxidation." British Thomson-Houston Co., Ltd. March 13th, 1923. (212,928.)

21,639. "Receiving sets for wireless telephony." R. B. Matthews and W. H. R. Pike. July 13th, 1925. (250,278.)

23,874. "Inductance coils, variometers, transformers, and the like applicable for use in high-frequency circuits." W. J. Rickets and J. W. Dunthorne. October 9th, 1924. (250,282.)

26,650. "Waterproof electric fittings." M. Sieverts Fabriks Aktiebolag. November 7th, 1923. (224,553.)

31,256. "Electrical control systems." Metropolitan-Vickers Electrical Co., Ltd. January 2nd, 1924. (227,114.)

31,262. "Electric gasfilled discharge tubes." Naamloose Vennootschap Philips' Gloeilampenfabrieken. September 11th, 1924. (Addition to 236,155.) (239,826.)

1925.

59. "Telephone exchange systems." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (C. R. H. Arntzenius). January 1st, 1925. (250,304.)

393. "Loud-speaking telephone apparatus." A. E. J. Vlug. January 6th, 1925. (250,308.)

833. "Impulse transmitters, particularly for use in automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). January 10th, 1925. (Cognate application 834/25.) (250,332.)

836. "Sparking plugs." E. Von Lepel. April 4th, 1924. (231,834.)

848. "Electrode supports for secondary batteries." J. Stone & Co., Ltd. (P. Butchart). January 10th, 1925. (250,333.)

1150. "Automatic or semi-automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). January 14th, 1925. (250,342.)

1,252. "Thermionic valves or electron-discharge tubes." Mullard Radio Valve Co., Ltd., L. S. Harley, and O. S. Pratt. January 15th, 1925. (250,343.)

1,601. "Electrically-heated toaster." B.-A.-G. Broncewarenfabrik Akt.-Ges. Turgi. February 1st, 1924. (228,522.)

1,760. "Electric illuminated advertising device." C. Gleerup-Moller. January 20th, 1925. (250,347.)

4,416. "Ferro-concrete foundations." W. Eccles, T. G. Williams, and Metropolitan-Vickers Electrical Co., Ltd. February 17th, 1925. (250,363.)

6,223. "Non-slipping and cushioning attachment for use with the metal straps or bands of wireless and other headphones." A. P. R. Willis. March 7th, 1925. (250,374.)

6,256. "High-tension batteries for wireless signalling apparatus." L. Kremner. March 7th, 1925. (250,375.)

6,938. "Methods of remote control for reversible electric motors." Smith, Major & Stevens, Ltd., and P. H. Stevens. March 14th, 1925. (250,377.)

6,984. "Independently-excited thermionic valve radio transmitters." Telefunken Ges. für Drahtlose Telegraphie. March 15th, 1924. (230,853.)

7,950. "Automatic and semi-automatic telephone systems." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.), R. A. More, and G. C. Hartley. March 24th, 1925. (250,381.)

8,187. "Electric time switches." G. E. Tate, F. O. Monkhouse, and A. F. Walters. March 26th, 1925. (250,386.)

8,564. "Arrester device for protecting wireless or other electrical apparatus from atmospheric electricity." S. E. Needham. March 31st, 1925. (250,388.)

14,577. "Voltametric measuring devices." Siemens Schuckertwerke Ges. June 18th, 1924. (235,865.)

14,767. "Diaphragms for acoustical instruments." L. Lumiere. June 7th, 1924. (235,522.)

14,891. "Electric batteries for clocks." B. Newth and O. Newth. July 7th, 1924. (236,531.)

15,303. "Pipes or conduits for electric cables." Callender's Cable and Construction Co., Ltd., and A. E. Wilson. June 12th, 1925. (250,424.)

16,428. "Microphones." E. Reisz. June 25th, 1925. (Patent of addition not granted.) (250,430.)

16,849. "Shock-absorbing mounts for thermionic valves or other electrical devices." Benjamin Electric, Ltd., and G. Campbell. June 30th, 1925. (250,431.)

18,172. "Electric lamp pivot." A. Lederer. July 16th, 1925. (Convention date not granted.) (257,891.)

18,457. "Electrically-operated surgical or dental instruments." W. J. Cameron. July 20th, 1925. (250,442.)

18,595. "Shock-absorbing sockets or holders for thermionic valves or other electrical devices liable to be injured or affected by shocks or vibrations." Benjamin Electric, Ltd. July 21st, 1924. (237,286.)

18,726. "Combined head-lamp, dimming switch, and horn switch for motor vehicles." N. B. Moss. July 22nd, 1925. (250,445.)

18,879. "Electrolytes for secondary batteries." L. F. Ducker. July 24th, 1925. (250,446.)

19,231. "Electric fuses." W. Whitehead. July 30th, 1925. (250,451.)

20,984. "Electromagnetic device producing a sustained intermittent movement." Soc. Anon. des Etablissements Tecalemit. September 2nd, 1924. (239,503.)

21,500. "Electromagnetic loud speakers." O. Bothe. September 26th, 1924. (240,425.)

21,701. "Thermionic valve holder." B. Nicholitch. August 29th, 1924. (250,460.)

22,533. "Regulating apparatus for electric supply systems." British Thomson-Houston Co., Ltd. September 23rd, 1924. (240,437.)

23,109. "Arc-welding apparatus." British Thomson-Houston Co., Ltd. September 16th, 1924. (240,159.)

24,047. "Holder for thermionic valves." B. Nicholitch. September 26th, 1925. (250,471.)

24,503. "Device for regulating electric voltages." Naamlooze Vennootschap Machinerieen-en Apparaten Fabrieken. October 9th, 1924. (241,187.)

25,402. "Electrical testing apparatus." G. A. Iler. October 12th, 1925. (250,476.)

25,418. "Loaded electrical conductors." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.) (Bell Telephone Laboratories, Inc.). October 12th, 1925. (250,477.)

25,459. "Electric flue-gas testing apparatus." G. Sokolow-Wichnevsky. October 12th, 1925. (250,478.)

27,596. "Electrical condensers." H. Seurat. November 4th, 1924. (242,642.)

28,331. "Electron discharge devices." Standard Telephones & Cables, Ltd. (Bell Telephone Laboratories, Inc.). November 10th, 1925. (250,485.)

29,369. "Electrodes of vacuum apparatus." W. Dallenbach. November 20th, 1924. (243,378.)

29,844. "Protective arrangements for electric distribution or supply systems." Switchgear & Cowans, Ltd., and G. H. Neep. November 26th, 1925. (250,494.)

30,580. "Methods of making insulators." D. H. Rowland. December 9th, 1924. (244,455.)

31,882. "Method of and apparatus for continuously cleaning insulators used in electrical gas-cleaning and dust-precipitating installations." Lodge-Cottrell, Ltd. (Metallbank und Metallurgische Ges. Akt.-Ges.). December 17th, 1925. (250,499.)

1926.

723. "Manufacture of lead-sheathed telephone cable." W. T. Henley's Telephone Works Co., Ltd., and W. Bone. January 9th, 1926. (250,507.)

1,314. "Automatic or semi-automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd., and F. Tench. January 6th, 1925. (Divided application on 249,248.) (250,510.)